

ADMISSIONS & RECORDS  
MEDICAL CENTER

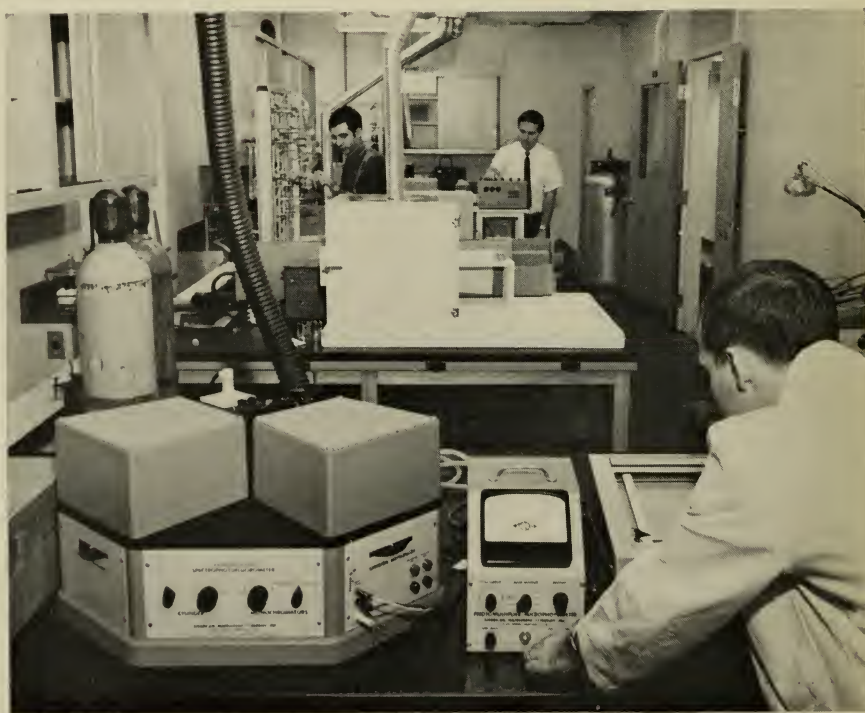
1970/71 CATALOG  
**THE GRADUATE SCHOOL**



**WEST VIRGINIA UNIVERSITY**



*WVU's new Computer Center (see page 18)*



*Chemistry research laboratory instruments room*

**West Virginia University**

**The Graduate School**

**1970-71**

**West Virginia University Bulletin**

# 1970

1970

JANUARY							FEBRUARY							MARCH							APRIL						
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# 1971

JANUARY							FEBRUARY							MARCH							APRIL						
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SEPTEMBER							OCTOBER							NOVEMBER							DECEMBER						
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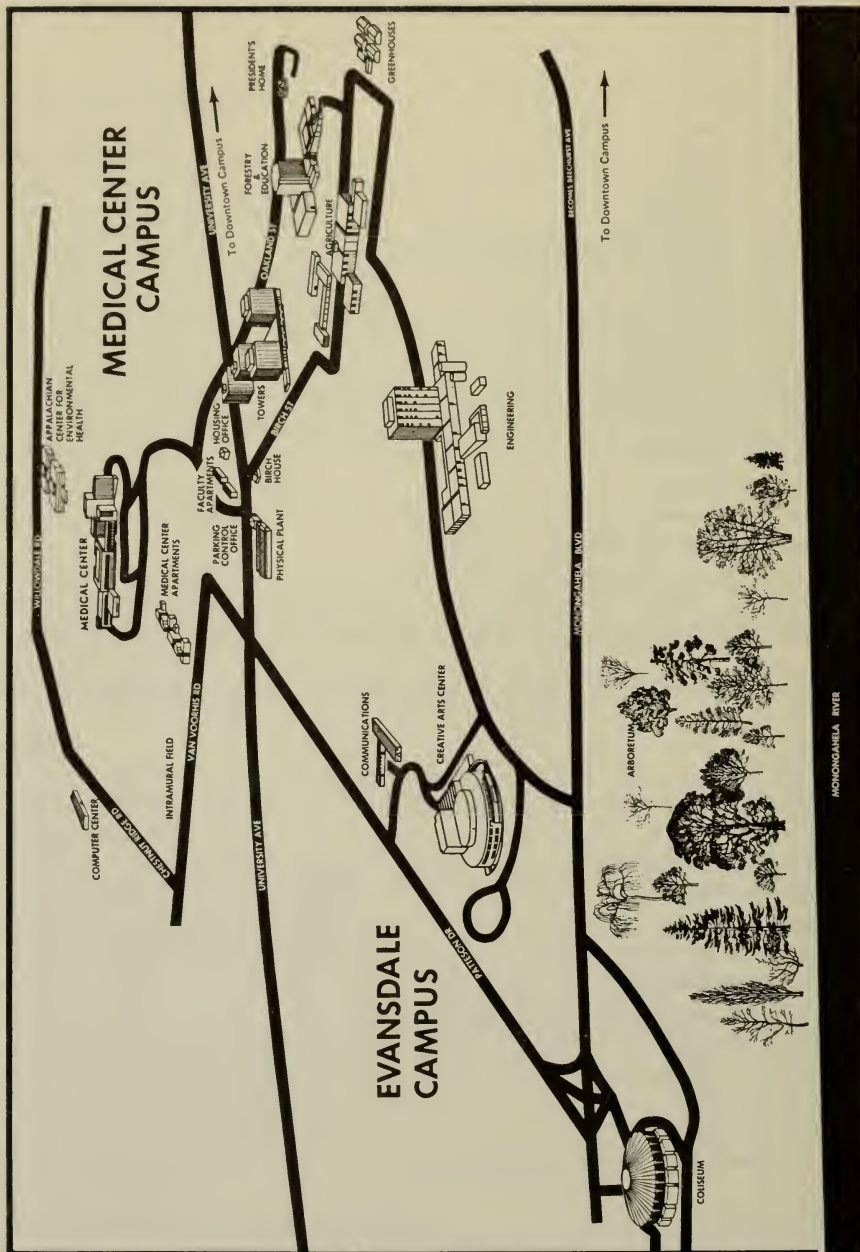
# University Calendar

1970

May 16, Saturday	Alumni Day
May 17, Sunday	Commencement Exercises
June 15, Monday	Registration for Summer Session
June 16, Tuesday	First Classes, First Summer Term
July 4, Saturday	Independence Day Recess
July 8, Wednesday	English Proficiency Examination
July 15, Wednesday	Close of First Summer Term
July 16, Thursday	First Classes, Second Summer Term
August 15, Saturday	Close of Second Summer Term
August 23, Sunday, to August 25, Tuesday, incl.	Freshman Orientation
August 24, Monday	General Registration, First Semester
August 25, Tuesday	General and Freshman Registration
August 26, Wednesday	First Classes, First Semester
September 7, Monday	Labor Day Recess
September 17, Thursday	English Proficiency Examination
October 13, Tuesday	Faculty Assembly Meeting
October 17, Saturday	Mid-Semester
October 23, Friday	Mid-Semester Reports Due
October 27, Tuesday	Graduate Faculty Meeting
November 25, Wednesday, to	
November 29, Sunday, incl.	Thanksgiving Recess
December 11, Friday	Last Classes, First Semester
December 14, Monday, to December 19, Saturday, incl.	Final Examinations, First Semester
December 20, Sunday, to January 4, Monday, incl.	Christmas Recess

1971

January 5 and 6, Tuesday and Wednesday	General Registration, Second Semester
January 7, Thursday	First Classes, Second Semester
February 4, Thursday	English Proficiency Examination
February 7, Sunday	West Virginia University Day
February 22, Monday	Washington's Birthday Recess
March 3, Wednesday	Mid-Semester
March 6, Saturday, to March 14, Sunday, incl.	Spring Recess
March 15, Monday	Mid-Semester Reports Due
March 16, Tuesday	Graduate Faculty Meeting
April 13, Tuesday	Faculty Assembly Meeting
April 30, Friday	Last Classes, Second Semester
May 3, Monday, to May 8, Saturday, incl.	Final Examinations, Second Semester
May 10, Monday	Grade Reports for Graduating Seniors and Graduate Students Due in Deans' Offices
May 11, Tuesday	Deans' Reports of Graduates Due in Registrar's Office
May 15, Saturday	Alumni Day
May 16, Sunday	Commencement





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For Higher Education, 1969/70**

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Earle T. Andrews, *Vice-President*, Berkeley Springs

Amos A. Bolen, *Secretary*, Huntington

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Prince B. Woodard, *Chancellor*, Charleston



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WVU Library (see page 18)

# The Graduate School

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 Homer C. Evans, Ph.D., *Professor of Agricultural Economics* (1970)  
 Leo Fishman, Ph.D., *Professor of Economics and Finance* (1972)  
 Ruel E. Foster, Ph.D., *Professor of English* (1971)  
 George E. Schafer, Ph.D., *Professor of Music* (1970)  
 Guy H. Stewart, Ph.D., *Professor of Journalism* (1971)



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TEACHER EVALUATION: C. M. Holland, *Chairman*; J. H. Bond, E. F. Gilbert, J. R. Hamilton, M. C. Howard, D. H. Parr, J. J. Renton, G. W. Rice, P. Zanowiak, and J. Barton II (ex officio)

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STATEMENT ON STUDENT RIGHTS AND RESPONSIBILITIES (February 10, 1969): P. E. Selby, *Chairman*; H. E. Kidder, and R. Stilwell

ADMINISTRATION (April 14, 1969): C. P. Yost, *Chairman*; S. Boyd, H. D. Collins, R. E. Foster, M. E. Gallegly, T. S. Isaack, J. A. Jacobsohn, F. Parker, H. G. Thompson, V. J. Traynelis, and D. T. Worrell

STUDY AND REVIEW OF ADVISING PROCEDURES (September 8, 1969): Jay Barton II, *Chairman*; J. F. Clovis, B. D. Holtan, W. A. Sack, and H. U. Taylor, Jr.

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*Cobalt 60 irradiation facility, Forestry Center*



# Part I / General Information

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West Virginia University, which was founded on February 7, 1867, combines in a single institution the functions of a state university and of a state land-grant university—functions commonly assigned to two or more institutions in other states. Thus the range and variety of instructional, research, and service programs at West Virginia University is greater than that of most institutions its size.

The primary mission of the University within the West Virginia system of higher education is to serve as the major center of professional and graduate training and research in the state. Graduate enrollments and graduate degrees granted have rapidly expanded during the past five years. From 1964 to 1969, Graduate School enrollments on the Morgantown campus increased from 1,418 to 2,069 and total graduate degrees granted per year increased from 507 to 958 (Ph.D. degrees from 9 to 58).

West Virginia University's total statewide enrollment was 19,119, including 14,114 students on the Morgantown campus, for the First Semester of the 1969-70 academic year. Of this total, almost 3,000 were enrolled in graduate and professional programs at Morgantown and 920 at the WVU Kanawha Valley Graduate Center serving the Charleston metropolitan area.

The major academic divisions of the University are: the College of Agriculture and Forestry; the College of Arts and Sciences; the College of Commerce; the Creative Arts Center; the School of Dentistry; the College of Engineering; the Graduate School; the College of Human Resources and Education; the School of Journalism; the College of Law; the School of Medicine; the Division of Military Science and the Division of Air Force Aerospace Studies; the School of Mines; the School of Nursing; the School of Pharmacy; and the School of Physical Education.

West Virginia University is a member of the North Central Association of Colleges and Secondary Schools. All of the University's educational programs are fully accredited by the North Central Association and by the appropriate accreditation agencies of the professional schools.

The academic year is divided into two semesters of approximately seventeen weeks each and a summer session of ten weeks, which is divided into two five-week sessions.

West Virginia University's growth in physical facilities since 1958 has been equaled by few universities of its size in the nation. During that time more than \$100 million in new buildings and facilities either have been built or are under construction in Morgantown.

They include a \$7.9 million Creative Arts Center; engineering and agriculture buildings costing \$10 million; the \$27.5 million Medical Center complex; \$18.4 million in dormitories and apartments; a \$5.4 million forestry building and tower annex; \$4 million in chemistry facilities; a \$10.5 million Coliseum; and the \$6.7 million activities center (Mountainlair) with its adjoining plaza and parking garage. A \$2.5 million Law Center to house the College of Law is being planned.

WVU has three campuses in Morgantown—the 75-acre Downtown Campus containing 46 buildings; the 275-acre Evansdale Campus, where future growth

probably will be concentrated, with 10 buildings; and the 260-acre Medical Center Campus. A University-operated bus system, considered a model by other universities, connects the three campuses.

For research and demonstration purposes, WVU operates nine experiment farms in Hardy, Jefferson, Mason, Monongalia, and Preston counties; six forests in Greenbrier, Mingo, Monongalia, Preston, Randolph, and Wetzel counties; a biological station near Terra Alta, Preston County; a geology camp near White Sulphur Springs; and 4-H facilities at Jackson's Mill, Lewis County.

In today's technological world, education has become too vital to stop at the edge of a university's main campus. West Virginia University operates branches in two of the state's most industrialized areas—the Kanawha Valley Graduate Center serving the Charleston area and the two-year Parkersburg Center. Potomac State College of WVU at Keyser is a two-year institution.

The University administers an off-campus educational program that touches the lives of thousands. They learn better ways of growing food and of mining coal, how to manage their money and to become wiser consumers, the techniques of community development, to work together in 4-H clubs, and learn to enjoy the pleasures of good music and art.

WVU's Center for Appalachian Studies and Development, organized in 1963, has pioneered nationally in broadening the role of the federally funded Cooperative Extension Service from strictly agricultural education to community development. The Appalachian Center takes expertise to the people through six area centers and offices in all of West Virginia's 55 counties. Field personnel help strengthen local antipoverty programs, they work to expand educational opportunities, they help farmers raise their incomes, and they participate in community development projects.

Other units of the Appalachian Center provide technical assistance to small businessmen, work with labor unions, educate firemen, coal miners, and teachers throughout the state, and investigate a variety of problems that bear on economic development including water resources.

The Office of International Programs is responsible for cooperative programs with the U. S. Agency for International Development (AID); for international contracts and agreements; and for administering and developing the overseas commitments of West Virginia University as they occur. It is also actively developing a climate favorable for expanded international activities on campus and for informing the public about affairs of international importance.

## **WVU KANAWHA VALLEY GRADUATE CENTER**

The West Virginia University Kanawha Valley Graduate Center (KVGC) was established in 1958 at Institute, just west of Charleston. Its primary functions are: (1) to offer disciplinary and interdisciplinary graduate degree programs relevant to the needs of the area's governmental, industrial, business, and educational segments; (2) to conduct basic and applied research related to those graduate degrees; and (3) to conduct graduate-level continuing professional development seminars, workshops, short courses, and similar series aimed at keeping the professional and already graduated and employed person abreast of new knowledge in his or her field.



As an integrated unit of West Virginia University, the KVGC's academic programs are coordinated with the graduate programs of the University and all courses are offered for credit in residence. Close association is maintained with the University as a whole, with area institutions of higher education, and with area program interests through a system of committees appointed by the President of the University.

Recent legislation and appropriations approved by the State Legislature have made possible a material expansion of both graduate enrollment and academic programs. Enrollment has increased from 83 graduate students in the fall of 1966 to 920 graduate students in the fall of 1969.

Programs of courses leading to the master's degree in business administration, education, engineering (chemical, industrial, and undesignated), industrial relations, mathematics, political science, public administration, and special education are presently offered by the graduate center. Certain courses applicable to degree programs in other fields of specialization are also available with the balance of the program being completed at the Morgantown campus. Additional graduate programs are being established whenever demand for them can be demonstrated and when the academic quality of such programs can be maintained.

The KVGC cooperates with Marshall University in cross-listing certain courses, primarily in education, which are approved by that institution for equivalent Marshall University graduate credit. Thus, both Marshall University and West Virginia University registrants who have been properly admitted to their respective graduate schools may, with the approval of their academic advisers, apply credit for such cross-listed courses at their parent institution.

The KVGC operates under the direction of a full-time administrative dean with three academic division directors, and both full and part-time faculty. The full-time faculty of KVGC is supplemented by professors from the graduate faculty at Morgantown, from the faculties of Marshall University and Kanawha Valley colleges, and from fully qualified local citizens who are approved by the academic unit and the WVU Graduate School to teach specific graduate courses. Most classes are conducted on the campus of West Virginia State College at Institute. A clerical office and work area for commuting instructors also is located on that campus in Room 107, Library Building. Additional classrooms and administrative and faculty offices of the KVGC are located in Nitro, a few miles west of the West Virginia State College campus.

For specific information about the KVGC, write to:

WVU Kanawha Valley Graduate Center  
Post Office Box 547W  
Nitro, West Virginia 25143  
Telephone: (304) 755-4313

## GOVERNMENT AND ORGANIZATION OF WVU

*The West Virginia Board of Regents* is vested by law with authority for the control and management of the educational, administrative, financial, and business affairs of the University and all other state institutions of higher education.

*The President* is the chief executive of the University. In this capacity, he is, *inter alia*, the principal academic officer and head of the faculties of the University, a role which his position as presiding officer of the University Senate symbolizes. The chief officers of administration, responsible and reporting directly to the President are: the Provost for Instruction, the Provost for Research and Graduate Studies, the Provost for Health Sciences, the Vice-President—Off-Campus Education, the Vice-President—Administration and Finance, the Vice-President—Planning, the Director of Student Educational Services, and the Director of Development.

*The University Senate* was established in November, 1945, as the vehicle for faculty participation in the government of the University. It is a legislative body with original jurisdiction over all matters of academic interest and educational policy that concern the entire University or affect more than one college, school, or division. The Senate's decisions are subject to review and approval by the President and the Board of Regents.

A new constitution for faculty participation in University government was put into effect. It includes the President of the University as Chairman, Provosts, Academic Deans, five administrative officers appointed by the President, and Senators elected by the members of the University Faculty Assembly to represent the college constituencies and other constituencies. Each constituency is entitled to one Senator for each twenty constituents who are members of the University Faculty Assembly.

*The University Faculty Assembly* includes the President of the University as presiding officer, Provosts, Academic Deans, Professors, Associate Professors, Assistant Professors, and Instructors holding appointments on a full-time basis in the University, and such other persons engaged in full-time professional activities responsive to the academic obligations of the University as have been approved for Membership and Constituencies. The Faculty Assembly normally meets twice a year.

West Virginia University also has a tradition of strong *student government* that touches all aspects of student life and represents student opinion to the administration and faculty. Student Administration has three main branches: Executive, including the student body president and vice-president who are elected every spring; Legislative; and the Academic Study Forum. Students also serve on twenty-two University committees, including the University Committee on Student Discipline (two student members and three faculty members), and the Mountainlair Advisory Council (four students and four faculty members), as well as numerous special and college/school committees.

## MORGANTOWN AREA

Morgantown is a city of 25,000 population. With suburban communities, its metropolitan area population is estimated at 40,000. The major growth of

Morgantown took place in the 1920s based on the coal-mining industry. Coal mining remains a major industry, but with mechanization of its operations, it now accounts for only 10 per cent of the labor force. Meanwhile, education and ancillary services have taken the coal industry's place as the principal source of local employment. West Virginia University itself is by far the largest single employer, accounting for some 20 per cent of Monongalia County's employment.

Located on the east bank of the Monongahela River, which flows north to Pittsburgh, Morgantown is situated on rugged terrain of the Appalachian Highlands. The altitude of the city varies from 800 to 1,150 feet above sea level, while the hills of the environs rise eastward to Chestnut Ridge which has altitudes of 2,600 feet just 10 miles from the city.

The area's invigorating temperate climate is marked by four distinct seasons of about equal length. Morgantown's valley location allows it to usually escape the extremes of winter—downtown snowfall averages only 25 inches annually and cold waves, which average about three a year, are blunted by the hilly terrain. Heavy winter clothing isn't usually needed until after the Thanksgiving recess.

Morgantown is served by bus and by Allegheny Airlines.

U.S. Routes 19 and 119 pass through Morgantown in the north-south direction. Pittsburgh is 72 miles due north. The cities of Charleston, W. Va., Washington, Baltimore, Cleveland, and Columbus, Ohio, all lie from 200 to 220 miles distant. A north-south interstate highway, I-79, is being constructed to pass just west of Morgantown.

Because of WVU's intellectual resources, the Morgantown area is becoming the major research center in the Appalachian region. Four federal agencies have located research facilities in the area—the Public Health Service (the Appalachian Center for Environmental Health), the Forest Service (the Forestry Sciences Laboratory), the Appalachian Experiment Station of the U.S. Bureau of Mines, and the Soil Conservation Service (West Virginia headquarters).

Two new installations add to the area's variety. They are the Robert F. Kennedy Youth Center, a model rehabilitation facility for youths who violate federal laws (mostly interstate car theft), and an earth tracking station of the Communications Satellite Corporation in neighboring Preston County (its 97-foot antenna sends and receives world-wide telephone and other communications from satellites in outer space).

## **LIVING ACCOMMODATIONS**

The University Housing Office, 440 Medical Center Road [phone (304) 293-3621], is the source of information concerning both University campus housing and privately-owned, off-campus housing. The University maintains seven residence halls, two for men and five for women. It also operates several hundred furnished and unfurnished apartments for married students, graduate students, faculty, and staff. There are many living accommodations in converted residences, in apartments, and in private homes, of which a few also board students. There is an increasing number of new large modern privately owned dormitories and apartment houses near the campuses. Most of these have units at reasonable rentals, but the earliest possible inquiries and attention to reservations are advised.



## **WVU LIBRARY SYSTEM**

The West Virginia University Libraries contain over 900,000 items, including approximately 650,000 physical volumes, 30,000 reels of microfilm, and 300,000 microcards. Some 30,000 volumes are added each year, and 5,000 periodical titles are currently received.

The Libraries have developed strength in several fields. The collections in the biological sciences, chemistry, engineering, sociology, Africana, the Southern Appalachians, and West Virginia history are especially strong. Facilities for research in West Virginia and regional history are centered in the West Virginia Collection. In addition to an extensive collection of books, periodicals, and maps, the Collection contains over 3 million manuscripts. These, together with court records from many counties, are invaluable sources for the study of all aspects of West Virginia history.

The Rare Book Room contains an unusually fine collection of first and limited editions, including the four Shakespeare folios, and the first editions of many of the work of Dickens, Scott, and Clemens.

During regular sessions, except on holidays and vacations, the Library is open from 7:55 A.M. to 12 midnight, Monday through Friday; from 7:55 A.M. to 5:00 P.M., Saturdays; and from 2:00 P.M. to 12 midnight, Sundays. During the Summer Session the weekday hours are from 7:55 A.M. to 9:00 P.M.; and only the Reserve Collection is available on Sundays, from 2:00 P.M. to 5:00 P.M. During periods when the University is not in session, the hours are from 9:00 A.M. to 5:00 P.M., Monday through Friday; 9:00 A.M. to noon Saturday; closed all day Sundays and holidays (New Year's Day, Washington's Birthday, Memorial Day, July 4, Labor Day, Thanksgiving Day, day before Christmas, and Christmas Day.) Changes in scheduled hours are posted in advance.

The Agriculture-Engineering Library, located on the second floor of the Engineering Sciences Building on the Evansdale Campus, consists of approximately 56,000 volumes. A public card catalog is maintained. In addition, cards for titles in the library are filed in the central Library catalog and are marked "Ag-Eng".

The Physical Sciences Library of approximately 20,000 volumes is located in the Chemistry Research Laboratory building.

The 80,000-volume Law Library is located on the second floor of the Law Building. Students may use this collection by applying at that library.

The Mathematics Library in the Mathematics Building has approximately 7,000 volumes.

The Medical Center Library is on the second floor of the Basic Sciences Building on the Medical Center Campus. It contains some 86,000 volumes with a complete public catalog. Author cards for titles in the Medical Center Library appear in the central Library catalog.

A Music Library of approximately 5,000 volumes and an equal number of scores is located in the Creative Arts Center.

## **COMPUTER CENTER**

The Computer Center is located at 837 Chestnut Ridge Road, directly across from the Medical Center heating plant. The equipment configuration at



this site includes an IBM 360/75 large scale general purpose electronic digital computer with 512K bytes of high speed 4-way interleaved core memory and 1024K bytes of low speed core storage; two 4.9 million byte magnetic drums and eight removable 29 million byte magnetic disks; one 7-track and two 9-track magnetic tape drives; two 1,100 lines-per-minute chain drive printers, one card read/punch device rated to read 1,000 cards per minute and punch 300 cards per minute; and teleprocessing control devices to simultaneously support the following remote terminals: two IBM 1130 computers (located in the Administration Building Annex and in Room 711, Engineering Sciences); one IBM 2780 Data Processing Terminal (located in the Medical Center); eight CRT display terminals; and thirty-one typewriter terminals. Services, available to faculty, graduate students, and staff, include:

*Seminars*—conducted regularly on such topics as computer fundamentals, languages, and using the library programs. Special requests for seminars may be made through the Academic Services section. Scheduled seminars are announced in the Computer Center newsletter.

*Library of General Purpose Programs*—includes the WVUCC Statistical Monitor, the BMD statistical package developed at UCLA, the IBM Scientific Subroutine Package, and many other programs and subprograms to support the research efforts of the users. User documentation for these programs may be obtained through the Information Controller at the Computer Center. Abstracts of all systems, programs and subprograms also are available.

*Consulting*—available to users through the Academic Services section. Program consultants are available at the center during normal working hours. A statistical consultant is available at the Administration Building Annex during normal working hours. These consultants are qualified to answer questions about system requirements, language specifications, computer center procedures and general programming, and data processing considerations. In addition, they each have special areas of interest and competence that may be relevant to particular user needs.

*Keypunching*—of programs and data for faculty, graduate students, and staff is provided by a competent keypunch section. All work is verified by an independent operator to minimize errors. It is recommended that all voluminous keypunching be submitted to the keypunch section in the Administration Building Annex.

*Test Scoring*—by optical page reader is available to all faculty members. This facility includes the capability of summarizing test results by class section and across all sections, of using more than one test key, and of performing a simple item analysis of the test.

*Programming*—is not generally done by Computer Center personnel for specific users. It is a full-time job to develop and maintain a general-purpose program library for all users. However, if a user has a programming need of sufficient generality, it will be considered by the Academic Services programming staff. Alternatively, the Computer Center Information Controller maintains a list of available student programmers. Users are expected to make their own arrangements with student programmers.

## CULTURAL ACTIVITIES

The University Cultural Series brings internationally recognized artists, theater repertory and ballet companies, symphony orchestras, and choral groups to the campus. It is funded by a student fee. Admission to these events is free to all full-time students, on presentation of validated identification cards.

Many cultural programs are presented without charge, including the convocation series which offers lecturers of national and international renown.

All performances of the resident artists, ensembles, some of the drama groups, and the fine arts exhibitions of the University Creative Arts Center are offered without charge. They include performances by resident artists, the University-Community Symphony Orchestra, the University Choirs, the University Choral Union, the University Symphonic Band, Percussion Ensemble, Opera Theater, and senior and graduate student recitals. Fine arts exhibits are presented by the Division of Art and by Mountainlair. The drama productions of the University Players, for which season tickets or a ticket for each performance may be purchased at nominal prices, draw large audiences. Holders of Mountainlair cards may attend additional concerts, films, and lectures offered for students. The Film Society, sponsored by Mountainlair, regularly schedules showings of international cinema classics. The Creative Arts Center and all its productions are housed in a new building, including concert hall, theater, studios, and educational facilities. Cultural events are publicized in a weekly Calendar of Events and by special announcements. They also are announced in the *Daily Athenaeum*, the Morgantown newspapers, and by means of posters.

Graduate students who wish to participate in musical groups as performers should inquire of the Division of Music where there are many such opportunities.

Many distinguished scholars lecture at the University each year under the sponsorship of the Provost's Office, the academic departments, Phi Beta Kappa, and other scholarly honoraries. These lectures are primarily directed to the specialized scholarly or professional interests of particular departments or colleges, but they are ordinarily open to members of the student body who may have an interest in them and they are so advertised.

## VETERANS

The University recognizes that men and women from the Armed Forces who enter college require individual and personalized guidance in order to facilitate their entrance and to aid their adjustment to University life. The Veterans Coordinator is available for consultation and help in the solution of personal problems which may arise in the transition to civilian student life.

Information regarding educational opportunities made possible at the University through provisions of the Veterans Readjustment Benefits Act of 1966—G.I. Bill (Public Law 358), the Vocational Rehabilitation Program of the Veterans Administration (Public Law 16), and the War Orphan's Educational Assistance Act of 1956 (Public Law 634) may be obtained from the Veterans Counselor by personal conference at his office in the Mountainlair or by mail. An amendment to Public Law 634, passed by Congress in the summer of 1964, provides benefits to many dependents of 100 per cent disabled veterans.

## **FOREIGN STUDENTS**

Of 205 foreign students from 45 different countries on the campus in September 1968, 122 were seeking Master's degrees or a Ph.D., and 83 were seeking undergraduate Bachelor's degrees.

The Foreign Student Office is located in Elizabeth Moore Hall. All new foreign students must contact the Foreign Student Office when they first arrive. The Foreign Student Adviser is available for guidance and counseling for individual foreign students. The Foreign Student Relations Committee of the Student Administration works closely with the office in an effort to bring the foreign and American students together for programs of international interest. Foreign students are encouraged to join the International Students' Association, an organization of foreign and American students interested in international relations. International students are also encouraged to join their particular nationality organizations. The Host Family Program provides foreign students an opportunity to meet and become acquainted with American families and visit in their homes.

All inquiries and applications from foreign students must be sent to the Director of Admissions. The Test of English as a Foreign Language (TOEFL) must be taken by all foreign students before they can be admitted to West Virginia University.

## **STUDENT FINANCIAL AIDS**

Information and guidance on loans for graduate students is available in the Financial Aids Office, Mountainlair.

On-campus employment opportunities can be investigated at both the Financial Aids Office and the Personnel Office of the University at 511 North High Street.

Financial award assistance for graduate students is usually based on initial recommendations by the department and school, division, or college in which the student is pursuing his studies. Information on fellowships, scholarships, grants, and assistantships at the graduate level is also available at department offices.

## **ASSISTANTSHIPS, FELLOWSHIPS, AND TRAINEESHIPS**

West Virginia University annually awards over 500 graduate assistantships supported from State appropriations, federal funds, private grants, and contracts; and about 200 fellowships and traineeships derived from federal programs such as HEA, NASA, NDEA, NIH, NSF, RSA, VA, etc. and from industrial and other non-public agencies.

Stipends for assistantships are generally stated in terms of 9 or 12 months' appointments for half-time service, i.e. 20 hours service per week in the case of research assistantships, and the assisting with instruction of two courses or the equivalent in the case of teaching assistantships. Most fellowships and traineeships require enrollment for full-time study but no formal teaching or research duties. Tuition and registration fees are generally remitted. Departments may



occasionally make appointments for more than or for less than half-time service with proportionately adjusted compensation. In the latter cases, the remission of tuition and registration fees is also reduced proportionately. Assistants giving half-time service are advised to take no more than 12 credit hours in any one semester and some College and Department regulations may be more strict in this regard.

Applications should be made by the first week in March to the Dean of the College concerned (not to the Dean of the Graduate School), the Directors of the Office of Research and Development, Water Research Institute, and the Regional Research Institute; or in the case of Agriculture and Forestry, Arts and Science, Engineering, and Medical Sciences, to the Chairman of the Department in which the student's course work will be pursued.

## **Agriculture and Forestry**

Graduate research assistantships at stipends of \$3,000 and \$3,600 for those holding Bachelor and Master Degrees, respectively, are available on a 12-month basis for half-time service, permitting a maximum of 10 hours per semester and waiving of tuition in Agricultural Biochemistry, Agricultural Engineering, Agronomy and Genetics, Animal Industry and Veterinary Science, and Plant Pathology and Bacteriology. Research assistantships at stipends of \$3,000 are available also in Agricultural Education, Forestry, and Horticulture.

Teaching assistantships at stipends of \$2,400 on a 9-month basis requiring half-time service, permitting a maximum of 10 hours per semester and waiving of tuition, are available in Agricultural Education, Agronomy and Genetics, Animal Industry and Veterinary Science, Forestry, Horticulture, and Plant Pathology and Bacteriology.

## **Arts and Sciences**

*Biology*—Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition and biology fees exempt. Research fellowships and assistantships with stipends comparable to teaching assistantships.

*Chemistry*—Teaching assistantships starting at \$2,400 for 9 months, half-time service, tuition and chemistry fees exempt. Research fellowships and assistantships supported by contracts and grants from government, private and industrial sources. Stipends comparable to teaching assistantships.

*English*—Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt. After 24 hours of graduate credit, the amount increases.

*Foreign Languages*—French, German, Spanish, Latin—Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

*Geology*—United States Steel Foundation Fellowship at \$2,400 for 9 months, tuition exempt. Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition exempt. Research assistantships supported by contracts and grants. Stipends comparable to teaching assistantships.

*History*—Teaching assistantship, up to \$2,000 for 9 months, half-time service, tuition exempt.

*Mathematics*—Teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

*Philosophy*—Assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

*Physics*—Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition exempt. Research assistantships supported by contracts and grants. Stipends comparable to teaching assistantships.

*Political Science*—Departmental assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

*Psychology*—Psychometric and laboratory assistantships up to \$2,200 for 9 months, half-time service, tuition exempt. Also USPHS and VA Traineeships at standard stipends.

*Speech*—Teaching assistantships, up to \$2,000, half-time service, tuition exempt.

## **Commerce**

*Business Administration and Economics*—Teaching or research assistantship up to \$3,500 for 9 months, half-time service, tuition exempt.

## **Creative Arts (Art, Drama, Music)**

Teaching, research, performance, and technical assistantships up to \$2,500 for 9 months, half-time service, tuition exempt.

## **Engineering**

Teaching fellowships in aerospace, chemical, civil, electrical, industrial, materials science, mechanical, nuclear engineering, and theoretical and applied mechanics, up to \$3,800 for 9 months, half-time service, tuition exempt. Air pollution control, solid waste, water supply and environmental science, graduate traineeships from \$2,400 to \$3,600 for 12 months plus dependency allowance, tuition exempt.

## **Engineering Experiment Station**

Research assistantships in aerospace, materials science, chemical, civil, electrical, industrial, mechanical, mining, nuclear, petroleum, and geological engineering, and theoretical and applied mechanics. Stipends \$175 to \$300 per month for 9 to 12 months, half-time service, tuition exempt.

## **Human Resources and Education**

*Clinical Studies*—Research and teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

*Education*—Research and teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

*Family Resources*—Teaching assistantships at \$3,000 for 9 months, half-time service, tuition exempt.

*Human Resources Research Institute*—Research and teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

*Rehabilitation Counseling*—Graduate traineeships for master degree candidates. Stipends: First 9 months, \$1,800, tuition exempt; second 9 months, \$2,000, tuition exempt.

*Social Work*—Graduate traineeships for master degree candidates. Stipends up to \$3,000 for 12 months, tuition exempt.

### **Institute of Biological Sciences**

Teaching assistantships will be available for qualified students.

### **Journalism**

Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

### **Medical Science**

Support from training, research, and other grants in anatomy, biochemistry, microbiology, pharmacology, and physiology; stipends from \$2,400 to \$2,800 for 12 months. Additional allowances for dependents.

### **Physical Education and Safety Education**

Teaching and research assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

### **Regional Research Institute**

A limited number of part-time research fellowships are awarded to graduate students who demonstrate a strong aptitude and interest in regionally-oriented basic research in the social sciences. Awards in variable amounts up to \$3,700 for 9 months, tuition exempt.

### **West Virginia Center for Appalachian Studies and Development**

*Office of Research and Development*—Research assistantships up to \$2,250 for 9 months and \$3,000 for 12 months, half-time service, tuition exempt.

*Water Research Institute*—Research assistantships up to \$2,700 for 9 months and \$3,600 for 12 months, half-time service, tuition exempt.

### **WVU Foundation Doctoral Fellowships**

The West Virginia University Foundation, Inc. has announced a new series of three-year fellowships for outstanding entering doctoral students in Graduate School programs. Departments are selected each year to make nominations for these awards to the Dean of the Graduate School. Stipends are \$4,000 for full-time, full-year enrollment or pro-rated at \$333 per month during the 9 months of the regular academic year. Inquire of the Chairman of the Department of major field as to the availability of such a fellowship in that department. There are now 12 WVU Fellows enrolled and 18 new fellowships are available in 1970-71.

### **AEC Special Fellowships in Nuclear Science and Engineering**

West Virginia University is a participant in the United States Atomic Energy Commission Special Fellowship Program which offers full tuition fel-



lowships in nuclear science and engineering to encourage promising students to undertake graduate studies in these fields. The fellowships are available for three years on a yearly renewable basis with annual stipends of \$2,400 for the first year, \$2,600 for the second year, and \$2,800 for the terminal year, plus an allowance of \$500 for each dependent. Applicants, who must be U.S. citizens, can obtain further information and application forms by writing directly to Fellowships Office, Oak Ridge Associated University, P. O. Box 117, Oak Ridge, Tennessee 37830. The final selection of appointees is made by a national fellowship board.

### **Danforth Graduate Fellowships**

For men and women under 30 with no previous graduate study who wish to prepare for a career in college teaching. One year awards normally renewable for total of four years. Stipend up to \$2,200 with dependency and other allowances. Recommendations made during first semester of student's senior year by departments to Dr. V. A. Peterson, 321 Armstrong Hall.

### **HEA Prospective Teacher Fellowships**

A number of two-year fellowships are authorized for award through certain departments under Title V, Part C of the Higher Education Act of 1965 for full-time graduate study towards the master's degree. They are not awarded to experienced teachers but to U. S. citizen students seriously interested in a career in elementary or secondary education such as recent college graduates (baccalaureate degree not less than three years ago), other college graduates who have never taught, or other college graduates who have not taught in recent years.

Stipends are \$2,000 for the first academic year and \$2,200 for the second academic year plus allowances of \$400 for each eligible dependent. An additional stipend of \$400 plus \$100 for each eligible dependent is available for summer study.

Inquiries should be made of department of student's major.

### **Kent Fellowships**

For men and women under 30 with some graduate work preparing for teaching or administration in American colleges and universities. Applications obtainable direct from Danforth Foundation, 607 North Grand Boulevard, St. Louis, Missouri 63103, for submission by December 17. Stipend up to \$2,800 with dependency and other allowances and renewal possible for a total of three years.

### **NDEA Title IV Fellowships**

The Office of Education, under supervision of the National Defense Education Act of 1958, as amended, supports three-year pre-doctoral fellowships in departments recommended by the University and selected by the U. S. Commission of Education. Candidates must be U. S. citizens or have permanent residence status and must certify intention to pursue a full-time course of study leading to a doctoral degree and interest in a career in college or university

teaching. Stipends vary from \$2,000 for first year to \$2,400 for third year, plus allowances of \$400 per year for each dependent. Nominations are made by approved departments after the grant award in November.

### **NSF Graduate Traineeships**

The National Science Foundation grants the University authority to select a number of trainees for study leading to master's or doctoral degrees in the mathematical, physical, medical, biological, engineering, and social sciences, and in the history and philosophy of science. Nominees must be U. S. citizens or nationals. Stipend is \$2,400 at first-year level, plus dependency allowance and opportunity of renewal. Nomination of trainees is by departments and selection is by a University interdisciplinary committee after the grant is awarded in January. These grants also provide for a limited number of summer traineeships for graduate teaching assistants.

### **NSF Graduate Fellowships**

Available for U. S. citizens or nationals in the fields of mathematical, physical, medical, biological, engineering, and social sciences, and in the history and philosophy of science. The student applies directly to the Fellowship Office, National Academy of Sciences, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418. The student may select his own graduate school, but it is his responsibility to obtain admission. Application deadline is about December 1.

### **Oak Ridge Fellowships**

The opportunity to participate in the Graduate Fellowship Program of the Oak Ridge Institute of Nuclear Studies is open to qualified students in the fields of biology, chemistry, engineering, mathematics, physics, and other scientific fields. When certified by the University and after completion of his course work, the student has the opportunity to conduct research using the facilities of the Oak Ridge National Laboratory and other Oak Ridge facilities. The basic annual stipend is \$3,000 with an allowance of \$500 for each dependent. Tenure is for the last year of course work on-campus and/or the final dissertation year at the Oak Ridge National Laboratory. In some cases, graduate students may be offered the opportunity to acquire research experiences through summer appointments at Oak Ridge National Laboratory prior to the time they are qualified to receive a fellowship.

### **Public Health Service Predoctoral Fellowships**

Available for U. S. citizens or those lawfully admitted to the U. S. for permanent residence having bachelor's degree or equivalent training. Graduate work must be in the basic sciences such as biology, chemistry, zoology, physiology, biochemistry, etc. as they relate to problems of health and disease. Among the social sciences, those areas such as psychology and sociology that relate to the problems of health and disease, and some interdisciplinary fields such as biostatistics, medical economics, cultural anthropology, etc. Stipend is

\$2,400 at first year level with \$500 for each qualified dependent and certain travel expenses; up to \$2,800 for candidate in final year of doctorate program. Application by form from Chief, Career Development Review Branch, Division of Research Grants, National Institutes of Health, Bethesda, Maryland 20014.

Under Public Health Service Grants, there are graduate traineeships available which include the fields of air pollution control engineering and other environmental engineering fields. The level of these is from \$3,000 for first-year students to \$3,600 for post-master's students plus \$500 per dependent, certain travel allowances, and tuition exempt. Information on these particular traineeships is available from the Department of Civil Engineering.

### **U.S. Steel Fellowship in Geology**

Inquire of Department of Geology.

### **Woodrow Wilson National Fellowship Foundation Program**

This foundation conducts a national identification program of 1,000 designates for graduate study awards including 150 Woodrow Wilson Fellowships for first-year graduate study leading to careers in college teaching particularly in the humanities and social sciences. Applicants nominated by a faculty member by October 31. Stipend \$2,000, tuition, and dependency allowance. Further information from Woodrow Wilson National Fellowship Foundation, Box 642, Princeton, New Jersey or Dr. V. A. Peterson, 321 Armstrong Hall.

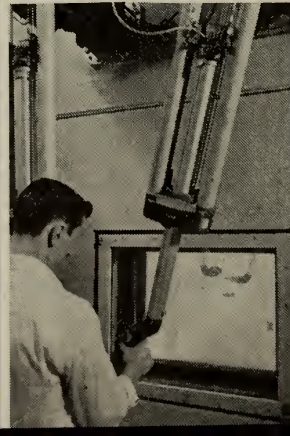
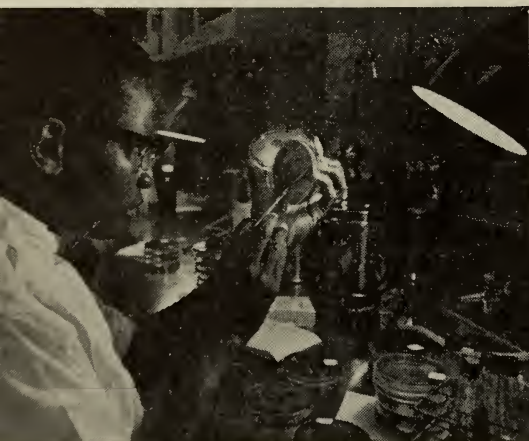
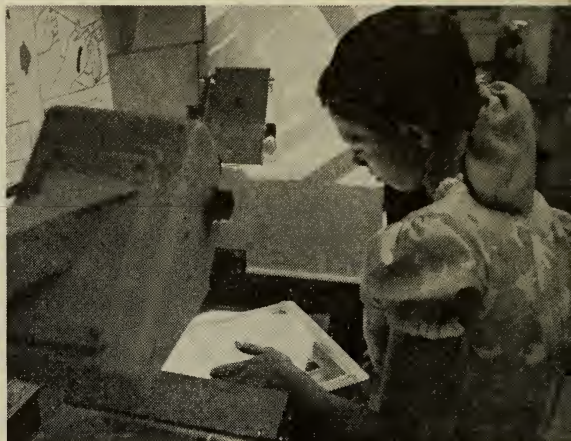
### **Additional Reference to Fellowship Opportunities**

"A Selected List of Major Fellowship Opportunities and Aids to Advanced Education for United States Citizens" provides excellent short summaries concerning sources of support for graduate study and research. Obtainable from the Fellowship Office, Office of Scientific Personnel, National Research Council, 2010 Constitution Avenue, Washington, D. C. 20418.

#### **Stipend Payment Dates For WVU Foundation, HEA, NASA, NDEA, and NSF Trainees and Fellows**

The start of entitlement periods under these awards is usually September 1 of each year. Invoices for payments are prepared in the Office of the Graduate School each month between the 10th and the 15th for entitlements earned during that month. Checks are normally available at the Office of the Graduate School for the students on the first day of the next month. Students to receive stipends under these programs must arrange their finances accordingly for their needs from the start of the fall semester to October 1.





## Part II / Academic Information

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The Graduate School was established in 1930. The Graduate School, as distinct from other colleges and schools, is University-wide, drawing together all the faculties and students of the University concerned with graduate study, and empowered to establish: policies and regulations covering the introduction of degree programs; degree, curricular, thesis, and dissertation requirements; standards of student scholarship; residency rules, etc., which take precedence over the policies and rules of particular colleges, schools, and departments.

All decisions on major policies and regulations affecting graduate study and the introduction of new degree programs are based on recommendations made by the Graduate Faculty, after study and advice by the Executive Committee of the Graduate Faculty and the Dean of the Graduate School. Responsibility for determining graduate faculty membership is essentially in the hands of the Executive Committee, acting on recommendation from the staff member's department chairman. The Executive Committee consists of eight members, the Provost for Research and Graduate Studies and the Dean, *ex officio*, and six graduate faculty members elected at large by the graduate faculty for staggered terms of three years. The Executive Committee normally meets once a month and calls meetings for the Graduate Faculty twice during the academic year.

In practice, much of the day-to-day administration of graduate study is conducted by the departmental chairman or graduate advisers responsible for the particular programs. At the University level, responsibility for administration of the graduate faculty's policies and regulations, resolving problems of interpretation of these rules, keeping student records, and preparing graduation lists is vested in the first instance in the Dean of the Graduate School (Graduate School Office, Room 104, Oglebay Hall).

### STUDENT CONDUCT

It is expected that students will come to the University with an earnest purpose to obtain an education and to apply themselves to that end. It is therefore expected that students will so conduct themselves as good citizens both within and without the University. To this end it is expected that they will conform to rules and regulations governing conduct and the use of facilities on the campus and that they will set for themselves a standard of personal conduct which will conform to the general community morals with respect to honesty, integrity, and respect for the property and rights of others. It is therefore Uni-

University policies and regulations affecting students are summarized in the **Student Handbook**. Every student is urged to obtain a copy of the **Handbook** from the Office of Student Educational Services, 109 Martin Hall, Downtown Campus.



versity policy that the student is required to conform to rules, regulations, laws and ordinances governing conduct as may have been promulgated by state and local governing bodies as well as the West Virginia Board of Regents.

It is expected, furthermore, that students will observe rules and regulations promulgated by the University for the purpose of insuring the peaceful and efficient conduct of the academic affairs of the University. These rules will govern conduct in facilities, the classrooms, and other areas of contact.

In addition to the foregoing, the University has promulgated certain rules and regulations covering cheating and the prosecution of cases involving violation of those rules. Reference is made to the *Undergraduate Catalog* and the *Student Handbook* for specific exposition of those rules and these rules are made applicable to graduate students as if fully rewritten herein.

## ADMISSIONS

### General

Prospective graduate students are strongly urged to initiate their admission applications as early as possible. March application for September admission is reasonable procedure.

Applications for admission to the Graduate School must be made on standard forms obtainable from the Office of Admissions. Applications must be submitted to the Office of Admissions and *not* to the Office of the Graduate School. The completed application forms must be accompanied by payment of a non-refundable special service fee of \$10.00. The applicant must at the same time request the registrar of the college of his baccalaureate degree to send an official transcript of his record directly to the Office of Admissions. The applications and transcript should be received at least one month in advance of registration.

Any student with a bachelor's degree who wishes to enroll in a 200-, 300-, or 400-level course who has not been formally admitted to a second bachelor's degree program must first be admitted to the Graduate School.

All students applying for admission to the Graduate School of West Virginia University must be approved by the department of their major interest before they will be officially admitted as graduate students by the Office of Admissions.

Students may be approved by the department of their major interest as:

1. *Regular graduate students.* Such students have been approved by a department for entrance into a degree program and have been officially admitted by the Office of Admissions.

2. *Probationary graduate students.* A probationary graduate student is one who has been approved for a degree program by the department of his major interest with a grade-point average below that required by that department, or whose grade-point average has fallen below that required of all degree candidates.

3. *Special graduate students.* A special graduate student is:

- a. One who is not pursuing a degree program.

- b. One who is in the process of removing course prerequisite deficiencies (not grade-point deficiencies) prior to approval for a degree program.



*Provisional admission* is granted in exceptional instances of late application to permit a student's records to be assembled and evaluated. It is always temporary and represents no other commitment to the student. Final approval is conditional upon receipt of a complete official final transcript (or transcripts) of previous college studies.

All departments shall require an undergraduate grade-point average of at least 2.5 for approval of candidates as regular or special graduate students. All departments shall require an undergraduate grade-point average of at least 2.0 of candidates for approval as probationary graduate students. All departments shall require that probationary graduate students achieve a cumulative graduate grade-point average of 2.5 at the end of the semester in which they complete their 12th semester hour of graduate work at West Virginia University. A department shall not permit students to continue in graduate programs unless they meet this requirement.

All departments shall require that graduate students maintain a graduate grade-point average of at least 2.5 to continue as regular graduate students. A student whose grade-point average falls below the requirement for regular graduate student status shall be placed on probation and required to remove his deficiency during the next semester in which he enrolls. If he fails to do so, he shall not be permitted to continue in the Graduate School.

A graduate grade-point average of at least 2.5 will be required for graduation from West Virginia University with a graduate degree.

Nothing in the foregoing prevents any department from establishing additional and higher requirements. These are described in Part IV of this catalog.

The Director of Admissions forwards a copy of the application to the department of the applicant's choice and will inform the applicant of the actions taken. If the applicant is admitted, he will be informed whether or not the department will approve his pursuing a degree program and any conditions thereof.

All graduate students are further classified as full-time or part-time students. A full-time student is one who is registered for 9 to 15 semester hours of work during a semester of the regular academic year, for 6 to 12 hours during the full 10-week summer session, and for 3 to 6 hours during a 5-week summer term. Graduate students registering for fewer hours than those listed above are classified as part-time students.

## **Graduate Record and Other Examinations**

The College of Human Resources and Education and certain departments of other WVU colleges require GRE scores before admission from all of their graduate students including those with a previous graduate degree. Some departments require scores *both* from the aptitude tests and the appropriate advanced test before making a decision on the admission application. Some departments require other tests such as the Miller's Analogy.

Students should arrange to take the tests required by the department of their prospective major (see Part IV) prior to the graduate registration at the University. If Graduate Record Examinations are required, the student should request the Educational Testing Service to forward their scores to the WVU department concerned.

Those planning to take the GRE must mail completed forms so as to reach the Educational Testing Service, Princeton, New Jersey, at least eighteen days prior to the date of the examination. The forms and examination dates are a part of the GRE information packet available at the WVU Graduate School Office or at other college centers throughout the country. The fee for the aptitude examination is \$8.00; for an advanced examination \$9.00, and for both examinations, if taken on the same day, \$15.00.

### **Foreign Students**

All applications for admission from students in whose baccalaureate college English was not the official language of instruction must take "The Test of English as a Foreign Language (TOEFL)." Such students must submit satisfactory TOEFL scores along with their admission forms to the Director of Admissions at least four months in advance of the proposed date of entry. Information on location of testing centers, dates of testing, and application forms should be obtained from TOEFL, Educational Testing Service, Princeton, N. J. 08540 USA.

### **Petitions by Seniors for Graduate Credit**

Seniors in the colleges of West Virginia University and in colleges where West Virginia University offers graduate courses by extension who are within 10 semester hours of graduation may, with the prior approval of the Dean of the Graduate School on special senior petition forms, enroll for graduate courses for which they may receive graduate credit after obtaining the baccalaureate and after being admitted to the Graduate School. Such graduate courses must not have been offered for undergraduate credit, and in every case the petition must have been approved before or at the time of enrolling for the course or courses. The maximum amount of graduate credit permitted under this regulation is 15 hours. Combined graduate and undergraduate credit must not exceed 18 hours in one semester or 12 hours in the summer session.

### **THE ADVISER**

Each department or other academic unit through which graduate degree programs are administered has one or more graduate advisers who are members of the graduate faculty. Every graduate student is assigned to such an adviser who arranges a specific cohesive, unified, continuous program of study with the student as early as possible before or after his first enrollment. The program is subject to approval by the Dean of the Graduate School and made a part of the student's records. The adviser will preside at the student's qualifying and final examinations.

### **REGISTRATION REQUIREMENT**

Each graduate student must be registered during the semester or session in which he takes the final examination. This requirement may be met by paying the "fee for examination of a candidate for a graduate degree" at the Comptroller's Office prior to the final examination.

## **CANDIDACY**

Admission to candidacy for any graduate degree is an additional requirement over and above admission to the Graduate School and admission to a graduate program in a particular department, school, or college. A candidate for a graduate degree is a student who has been officially admitted to the Graduate School and to a graduate program and has satisfactorily completed a suitable period of graduate work in residence as a regular graduate student in which ability to do work of graduate caliber is demonstrated to the satisfaction of his adviser and graduate committee. It is usually established by successful completion of a departmental qualifying examination as further explained in the following pages under requirements for the Doctor's degree, and in Part IV of this catalog.

## **CREDIT LIMITATIONS**

### **General**

Credit toward a graduate degree may be obtained only for courses listed in these *Announcements* and numbered 200-499 in which the grade earned is A, B, C, or S. No courses in which the grade earned is F, D, or U can be counted toward a graduate degree. No residence credit will be allowed for special field assignments or other work taken off the University campus without prior approval by the Dean of the Graduate School.

No more than 15 hours of graduate course in any one semester, no more than 12 hours of graduate courses in any one 10-week summer session and no more than 6 during a 5-week summer term may be carried by a student. Any exception to this rule must be approved by the Dean of the Graduate School.

### **Transfer Credit**

No more than 12 hours of graduate credit obtained at other approved institutions may be considered for transfer toward meeting the requirements for the Master's degree at West Virginia University. Approval in writing from the Dean of the Graduate School must be secured in advance to take graduate courses offered elsewhere. Graduate credits so accepted must meet requirements for a continuous and unified program of graduate study. They will reduce correspondingly the number of hours of extension graduate credits which may be accepted toward meeting the requirements for the Master's degree. The total of transfer plus extension credits applicable toward the degree is 15.

The above regulation applies to all Master's degrees based on a total credit requirement of 30 to 46 semester hours. The degree of Master of Social Work is based on a total credit requirement of not fewer than 61 semester hours, 24 to 30 of which may be transferred under suitable conditions, but the last 30 of which must be earned and completed at West Virginia University.

### **Extension Credit**

No credits earned by extension prior to admission to the Graduate School and acceptance to a degree program of graduate study may be counted toward the Master's degree except under the senior petition regulation. No more than



15 hours of extension credit or combination of extension credit and transfer credit may be counted toward the Master's degree.

For majors in the Division of Education of the College of Human Resources and Education no more than 9 hours in extension may be obtained before the student completes at least 6 hours in residence on the campus. Full-time in-service teachers may obtain no more than 9 semester hours of credit toward the Master's degree in any one academic year. The maximum amount of extension graduate credit that may be received in any one field is 9 semester hours.

### **Employed Graduate Students**

Graduate students will be required by their advisers to limit their credit loads in proportion to the outside service rendered and the time available for graduate study. In general, persons in full-time service to the University, or other employer, will be advised to enroll for no more than 6 hours of work in any one semester and those in half-time service for no more than 12 hours. Maximum credit loads may be less for employed graduate students in some academic colleges and departments.

### **Maximum Time for Completion**

Completion of requirements for any graduate degree must be accomplished within a period of 7 years. For a Master's degree the period starts at the initial enrollment for a graduate course after the Bachelor's degree is conferred. The same is true for a Doctoral degree, although when there is an intervening award of a Master's degree the seven-year period for completion of the Doctorate starts at the initial enrollment for a graduate course after the Master's degree is conferred. Credits lost at the beginning of a graduate program under this regulation will not usually be considered for revalidation and then only upon formal petition to the Dean of the Graduate School by the student's graduate adviser or committee chairman showing a completion program which the student must meet.

### **SCHOLARSHIP**

To be in good standing, a graduate student must maintain a cumulative graduate course grade-point average of 2.5. A student whose grade-point average falls below 2.5 will be placed on probation and required to remove the deficiency during the next semester for which he enrolls. If he fails to do so, he shall not be permitted to continue in the Graduate School. A student who fails one-half or more of the work for which he is enrolled during any semester or summer session will be suspended. This regulation is a minimum standard for the Graduate School and the higher scholarship requirements that most departments have must also be met. A student who has not been accepted in one of the graduate student categories by the department of his choice may not enroll in courses. If he enrolls in such courses, his enrollment may be withdrawn. Credit hours for courses in which the grade is lower than "C" will not count toward satisfying graduate degree requirements.

## GRADING

- A—excellent (given only to students of superior ability and attainment)
- B—good (given only to students who are well above average, but not in the highest group)
- C—fair (average students)
- D—poor but passing (cannot be counted for graduate degree credit)
- F—failure
- I—incomplete
- W—withdrawal prior to the end of the fifth week of a semester or withdrawal doing satisfactory work thereafter
- WU—withdrawal doing unsatisfactory work (after the fifth week of a semester)
- X—auditor, no grade and no credit
- CR—credit but no grade

## Certain Approved Graduate Courses

- S—Satisfactory
- U—Unsatisfactory (Equivalent to F)

## THESES AND DISSERTATIONS

These shall be presented to the student's departmental graduate adviser or committee chairman at least one month for masters candidates and two months for doctoral candidates before the end of the semester or summer session in which completion of all requirements is expected. The form prescribed under the Graduate School "Regulations Governing the Preparation of Dissertations and Theses" must be followed with the guidance of the student's graduate adviser or chairman of the student's graduate committee. In order for the manuscript to be approved there shall be no more than one unfavorable vote among members of the student's committee. Two accepted copies in approved type-written form (problem reports and thesis in bound form and dissertations unbound) shall be delivered to the Office of the Graduate School at least one week before the close of the period in which the degree is expected to be completed (one week before the end of the summer session, one week before the end of the final examination period at the end of the first semester, or one week before Commencement Day at the end of the second semester). Additional regulations are described under specific degree requirements in the following pages, and in the "Information and Check Lists for Masters Candidates" and a corresponding leaflet for Doctoral Candidates, available at the Office of the Graduate School. Problem reports are deposited with the major department in the form required.

## FINAL EXAMINATIONS

The final examinations shall not be given until the semester or summer session in which all other requirements for the degree are to be met. In programs requiring a thesis, or dissertation the final examination must follow com-

mittee approval of the manuscript. The student's adviser or committee chairman must notify the Office of the Graduate School in advance of the time, place, and recommended examining committee membership and receive back clearance in the form of the student's "Shuttle Sheet" before the examination can be given. Such notifications of doctoral examinations must be received in the office of the Graduate School at least three weeks in advance of the examination date. All doctoral final oral examinations are open examinations and the lead time is required for public notice to the University community. Examining committees shall be comprised of no fewer than three members for the Master's degree and no fewer than five members for the Doctor's degree. The majority must be members of the Graduate Faculty and it is customary to have at least one member from a department other than that of the student's major field. After January 1, 1971, the majority of doctoral committee members must be members (full members) of the Graduate Faculty under the new regulations adopted October 29, 1968. Every doctoral committee must include at least one member of a department other than that of the major field of the doctoral program. The student cannot be considered as having satisfactorily passed the final examination if there is more than one unfavorable vote among members of the examining committee. Results of each examination must be reported to the Office of the Graduate School. Re-examination may not be scheduled without approval of the Dean of the Graduate School.

## **REQUEST FOR DEGREE**

At the time of registration for the semester or the summer session in which all degree requirements are expected to be met, or at the latest within two weeks after such registration, each candidate shall submit a formal request on a special "Application for Graduation and Diploma" form to the Dean of the Graduate School for the conferring of the degree. The candidate must complete all requirements at least one week before the end of that semester or summer session. If the degree is not actually earned during that semester then the student must submit a new "Application for Graduation and Diploma" at the beginning of the term in which he does expect to meet all requirements.

## **COMMENCEMENT ATTENDANCE**

Students graduating as of the close of the second semester are required to participate in the commencement exercises unless excused in writing by the Dean of the Graduate School. Students graduating as of the close of the summer session and as of the close of the first semester are not required to participate in the commencement exercises but are invited to do so. All doctoral graduates as of the close of the first semester or as of the close of the summer session must notify the Office of the Graduate School as to their participation in the commencement exercises.



THE DEGREES OF MASTER OF ARTS  
AND MASTER OF SCIENCE

Requirements

*General:* The regulations governing admission, registration, establishment of candidacy, scholarship, theses, final examinations, etc. described in the preceding sections must be followed. These are also summarized in the "Information and Check List for Masters Candidates" available at the Office of the Graduate School.

*Program:* No less than 30 hours of graduate work planned with the student's graduate adviser must be satisfactorily completed within a period of seven years immediately preceding the conferring of the degree. The program must be formulated in writing at the earliest possible date so as to result in a cohesive, unified and continuous plan of study. In degree programs requiring a thesis or problem report, appropriate courses may be taken to cover the research and writing, but no more than 6 hours of credit earned for research or thesis may be counted in meeting course requirements for the degree. In most departments the program consists of certain amounts of work in major and minor fields. These are described in the departmental programs of Part IV in this bulletin.

*Special:* Each student, through consultation with his graduate adviser, must meet the special requirements of the faculty of the field in which he pursues his major study, subject to approval of the Dean of the Graduate School.

Degrees

Fields or departments through which these degrees are offered are as follows:

*Master of Arts (A.M.) with a major in:*

Art	German
Biology	History
Counseling and Guidance	Mathematics
Drama	Philosophy
Economics	Political Science
Education Administration	Psychology
Educational Psychology	Reading
Elementary Education	Secondary Education
English	Sociology
French	Spanish
Geology	Special Education
	Speech

*Master of Science (M.S.) with a major in:*

Agricultural Biochemistry	Biochemistry (Medical)
Agricultural Economics	Biology
Agricultural Education	Chemistry
Agronomy	Entomology
Anatomy	Family Resources
Animal Science	Genetics

Geology  
Horticulture  
Industrial Relations  
Mathematics  
Medical Technology  
Microbiology (Med. and Agr.)  
Orthodontics  
Pharmaceutical Sciences  
Pharmacology  
Physical Education  
Physics

Physiology and Biophysics  
Plant Pathology  
Plant Physiology  
Recreation  
Rehabilitation Counseling  
Reproductive Physiology  
Safety Education  
Speech Pathology and Audiology  
Statistics  
Wildlife Management  
Wood Science and Technology

*Master of Science in the following designated fields:*

Aerospace	Industrial Engineering (M.S.I.E.)
Engineering (M.S.A.E.)	Journalism (M.S.J.)
Agricultural	Mechanical
Engineering (M.S.Ag.E.)	Engineering (M.S.M.E.)
Chemical	Mechanics (M.S.T.A.M.)
Engineering (M.S.Ch.E.)	Engineering of Mines (M.S.E.M.)
Civil Engineering (M.S.C.E.)	Petroleum
Electrical Engineering (M.S.E.E.)	Engineering (M.S.Pet.E.)
Engineering (M.S.E.)	
Forestry (M.S.F.)	

*Other designated Master's degrees:*

Master of Agriculture (M.Ag.)  
Master of Business Administration (M.B.A.)  
Master of Music (M.M.)  
Master of Public Administration (M.P.A.)  
Master of Social Work (M.S.W.)

## **CERTIFICATE OF ADVANCED STUDY IN EDUCATION**

This Certificate is conferred for successful completion of a program through the College of Human Resources and Education for students who have a Master's degree (see page 190).

## **THE DEGREE OF DOCTOR OF PHILOSOPHY**

### **General Requirements**

The regulations governing admission, registration, scholarship, etc., described in the preceding sections must be followed. Students applying for admission to a doctoral program after having received a Master's degree at West Virginia University must file a new completed form for admission to the Graduate School with the Office of Admissions. This is to insure the intent and proper records of the student and does not entail an additional admissions special service fee.

## Candidacy Requirements

Admission to the Graduate School and enrollment in graduate courses does not of itself imply acceptance of the student as a candidate for a Ph.D., degree. This is only accomplished by (1) satisfactorily passing a comprehensive preliminary or qualifying examination (either oral, or written, or both) and (2) by meeting the Ph.D. language requirements.

(1). *Qualifying Examination*: After a period of residence the student will be admitted to a comprehensive examination in which he must demonstrate a grasp of the important phases and problems of the field of study in which he proposes to major; their relation to other fields of human knowledge and accomplishments; and the ability to employ rationally the instruments of research that have been developed in his major field. The scheduling and results of each such examination must be reported to the Office of the Graduate School (see Final Examination, page 35).

(2). *Foreign Language Examinations*: The foreign language requirement of the Graduate School is that the student demonstrate the ability to read one foreign language in a satisfactory manner. This may be any language in which there exists a significant literature in the student's major field of study, and which is acceptable to the student's major department and to the Dean of the Graduate School. For any language other than French, German, or Russian, approval of the Dean must be requested by the student's adviser. A petition for such approval must give evidence that journals and other sources in the student's field are comparable to those in French, German, and Russian, that they are as readily available to the student and that they will be consulted during his dissertation research.

The Ph.D. programs offered through a number of departments require a reading knowledge of two foreign languages or of one language in greater depth than the minimum requirement of the Graduate School.

Language examinations are arranged by the Foreign Language Examiner who is a member of the faculty and is appointed by the Dean of the Graduate School with the advice of the chairman of the Department of Foreign Languages. Examinations are administered by a person or persons selected by the Foreign Language Examiner at stated times, in general, twice each semester and once during the summer. Material in the student's field of specialization is approved by the adviser, and the student is allowed to prepare in advance for examination of this material. When translating unfamiliar material, the student will be allowed to use a dictionary. If a student fails the examination, his adviser may request a review of his examination papers. This review will be conducted by a committee of three members appointed by the Dean of the Graduate School. One member of the committee shall be a member of the faculty of the Department of Foreign Languages. The Foreign Language Examiner shall report to the student's adviser and to the Dean of the Graduate School the results of language examinations and examination reviews.

The Foreign Language Examiner also administers the following provisions:

The completion of 12 semester hours or equivalent of course work in an approved foreign language with a grade of B or better in the last three hours, at West Virginia University or at any other institution of recognized standing,



will be accepted as satisfying the reading requirement of a language, provided that it was completed no more than seven years prior to promotion to candidacy for the Ph.D.

The completion of French 206 at West Virginia University with a grade of B or better within seven years of promotion to candidacy for the Ph.D. will be accepted as satisfying the reading requirement in French.

When a student is certified as having satisfied his language requirement and has successfully completed his qualifying examination he is promoted to candidacy for the Ph.D.

### **Program**

The program of Ph.D. study is planned with the student's graduate adviser and committee to combine any or all of the following: Graduate courses of instruction, special seminars, independent study, supervised research, and supervised teaching designed to promote a broad and systematic knowledge of his field and to prepare the student for the comprehensive qualifying and final examinations and writing of the dissertation.

### **Residence**

The program for the Ph.D. generally requires at least three years of full-time graduate work beyond the Bachelor's Degree. This must include a minimum of two semesters of residence in full-time graduate study at West Virginia University.

### **Dissertation**

The candidate must submit a dissertation pursued under the direction of the faculty of this University on some topic in the field of the major subject. The dissertation must present the results of the candidate's individual investigation and must embody a definite contribution to knowledge. While conducting research or writing a dissertation the student must register at the beginning of each semester or summer session during which credit is being earned.

### **Special Requirements**

The student must satisfy such special requirements, subject to the approval of the Dean of the Graduate School, as may be required by the faculty responsible for his major field. All of the requirements for the degree shall be completed within a period of seven years.

### **Final Examination**

If the candidate's dissertation is approved and he has fulfilled all other requirements, he will be admitted, upon proof of current registration and approval by the Dean of the Graduate School, to a final oral examination on his dissertation before his examining committee. At the option of the department or the committee, a comprehensive final written examination also may be required. Results of the examination, acceptance of the dissertation, and certification of its suitability for immediate publication must be reported by the committee chairman to the Office of the Graduate School not later than one week

before the end of the semester or summer session in which the degree is expected to be granted (one week before the end of the summer session, one week before the end of the final examination period of the end of the first semester, or one week before Commencement Day at the end of the second semester).

## Publication of Dissertation

All Ph.D. and other Doctoral Dissertations and their abstracts will be microfilmed through University Microfilms, Ann Arbor, Michigan. This requirement will not be satisfied by any other publication but does not preclude publication elsewhere which is both permitted and encouraged.

Candidates are to follow "Regulations Governing the Preparation of Dissertations and Theses" regarding format, paper, and organization of the dissertation and "A Review of Copyright Matters Related to Graduate Theses and Dissertations" for information pertaining to copyrights. Both of these papers are on file at the Office of the Graduate School, Department offices, offices of all Graduate advisers, and the University libraries. The candidate is required to maintain close contact with his supervisor or chairman of his graduate committee on these matters in developing his dissertation so as to incorporate the special requirements of the subject discipline.

One week before the close of the semester or summer session in which the degree is expected to be conferred the candidate must meet the following requirements as well as others described in the "Information and Check List for Doctoral Candidates" obtainable at the office of the Graduate School:

1. Submit to the Office of the Graduate School, in form satisfactory for microfilming, the typewritten, unbound original and first carbon copy of the dissertation signed by the candidate's committee. Two excellent machine-reproduced copies may be acceptable if approved in sample in advance and final copies conform.

2. Submit to the Office of the Graduate School one abstract as above of the dissertation consisting of no more than 600 words.

3. Submit to the Office of the Graduate School a microfilm contract completed and signed by the candidate.

4. Pay a fee of \$30.00 at the Office of the Graduate School to cover the cost of microfilming the dissertation and publication of the abstract in *Dissertation Abstracts*, a bi-monthly journal which receives wide distribution. Check must be made out to "Dissertation Service." If copyright service is desired, it can be provided through the Office of the Graduate School upon receipt along with the dissertation of a certified check for \$10.00 made payable to "University Microfilms."

5. Complete the questionnaire entitled "Survey of Earned Doctorates" obtained at the Office of the Graduate School and return it there.

## Major Fields

*Programs toward the Ph.D. are offered in the following major fields:*

Aerospace Engineering  
Agricultural Biochemistry  
Agronomy

Anatomy  
Animal Nutrition  
Biochemistry (Medical)

Biology  
Chemical Engineering  
Chemistry  
Civil Engineering  
Economics  
Electrical Engineering  
Genetics  
Geology  
History  
Mechanical Engineering  
Microbiology (Med. and Agr.)

Music  
Pharmacology  
Physics  
Physiology  
Plant Pathology  
Plant Physiology  
Political Science  
Psychology  
Reproductive Physiology  
Theoretical and  
Applied Mechanics

## **THE DEGREE OF DOCTOR OF EDUCATION**

The degree of Doctor of Education is offered through the College of Human Resources and Education. Programs leading to the degree with a major in Curriculum and Instruction and emphasis in Music Education are offered cooperatively with the Creative Arts Center (see p. 134) and those leading to the degree with a major in Curriculum and Instruction and emphasis in Physical Education or Safety Education are offered cooperatively with the School of Physical Education (see p. 259). The major areas and emphasis are:

1. Curriculum and Instruction
  - a. Educational Psychology
  - b. Elementary Education
  - c. Health Education
  - d. Industrial Arts Education
  - e. Music Education
  - f. Physical Education
  - g. Reading
  - h. Safety Education
  - i. Special Education
2. Counseling and Guidance
3. Education Administration

## **THE DEGREE OF DOCTOR OF MUSICAL ARTS**

The degree of Doctor of Musical Arts is offered through the Creative Arts Center. The degree program is described on page 138.



# Part III / Financial Information

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## FEES AND EXPENSES

All University fees are subject to change without notice.

A non-refundable special service fee of \$10.00 must accompany applications for admission to the Graduate School.

All fees are due and payable at the Comptroller's desk in the Field House Annex (south) on the days of registration. Students must pay fees before registration is accepted and class tickets are released. Completion of arrangements for payment from University payroll check, officially accepted scholarships, loan funds, grants, or contracts shall be considered sufficient for acceptance of registration. Fees paid after regular registration must be paid to the University Cashier in Mountainlair. Any student failing to complete registration on regular registration days is subject to the Late Registration Fee of \$10.00. Students registering pay the fees shown on page 45 plus special fees and deposits as required.

No degree will be conferred upon any candidate prior to payment of all tuition, fees, and other indebtedness to any unit of the University.

### Special Fees

Late-registration Fee (non-refundable) <sup>1</sup> .....	\$ 10.00
Graduation Fee <sup>2</sup> .....	10.00
Professional Engineering Degree (including \$10.00 graduation fee) .....	25.00
Student's Record Fee <sup>3</sup> .....	1.00
Fee for Change in Registration (after 8th day) .....	1.00
Certificate of Advanced Study in Education .....	2.00
Fee for Reinstatement of Students Dropped From the Rolls .....	3.00
Fee for Examination of Candidates for Graduate Degree <sup>4</sup> .....	1.00
Diploma Replacement Fee .....	5.00
Physical Education Student Fee .....	5.00
Student Identification Card Replacement Fee .....	1.00
Social Work Field Supervisory Fee (per semester) ...	70.00

## Mountainlair Construction Fee and Daily Athenaeum Fee

The following fees are charged all students, full-time and part-time, who are enrolled for regular courses of resident instruction at West Virginia University in Morgantown:

Mountainlair Construction Fee . . . .	\$20.00	per semester
Daily Athenaeum Fee . . . . .	\$ 1.50	per semester
Mountainlair Construction Fee . . . .	\$12.00	per summer term in excess of five weeks
Mountainlair Construction Fee . . . .	\$ 6.00	per five-week summer term or any portion thereof
Daily Athenaeum Fee . . . . .	\$ 1.00	per full summer session

These fees are non-refundable unless the student withdraws officially before the close of General Registration for the term or course in which he has been enrolled.

## Fees for Extension Courses

A fee of \$12.00 per semester hour and an off-campus extension fee of \$12.00 per course are charged for enrollment in each extension course. Fees for extension courses are due and payable at or prior to the first class meeting.

## Undergraduate and Graduate Music Students

Full-time or part-time students registered for Bachelors' or advanced degrees in Music or the Supervisory Training Program in Music shall pay the regular full-time or part-time fees for all courses in music. No additional fees are assessed for Applied Music.

Students registered in other colleges or schools, including the Graduate School, may enroll in class courses in music at the regular full-time rate or part-time fee per credit hour. These students may also enroll for Applied Music for a maximum of one half-hour lesson per week for one hour credit. The fee for this Applied Music instruction shall be \$20.00 in addition to the aforementioned tuition and registration fee. See the University *Undergraduate Catalog* for additional details on fees.

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<sup>1</sup>This fee is not charged to full-time students who complete registration during the regular registration days as set forth in the University Calendar. This fee is not charged to part-time students who complete registration by the close of office hours on the eighth day following the beginning of General Registration.

<sup>2</sup>The Graduation Fee is payable by all students at the beginning of the semester or session in which they expect to receive their degrees.

<sup>3</sup>One transcript of a student's record is furnished by the Registrar without charge. This fee is charged for furnishing an additional transcript.

<sup>4</sup>For graduate students not otherwise enrolled at time of final examination.

SEMESTER FEES IN THE COLLEGES AND SCHOOLS

(See Footnotes 5, 6, 7, 8, 9)

College, School, Or Division	Full Time	
	Resident	Nonresident
<i>GROUP I</i>		
Agriculture and Forestry		
Arts and Sciences		
Commerce		
Creative Arts Center		
(Music, Art, Drama)	\$90.00* plus Registration	\$255.00* plus Registration
Engineering	Fee of \$50.00.	Fee of \$200.00.
Human Resources and Education		
Journalism		
Mines		
Physical Education		
<i>GROUP II</i>		
Dental Hygiene		
Law		
Medical Technology (Jr. and Sr. Years)	\$105.00* plus Registration	\$280.00* plus Registration
Nursing	Fee of \$50.00.	Fee of \$200.00.
Pharmacy		
<i>GROUP III</i>		
Dentistry	\$167.00* plus Registration	\$385.00* plus Registration
Medicine	Fee of \$50.00.	Fee of \$200.00.

Part Time

<i>Tuition, per semester hour</i>	<i>Resident</i>	<i>Nonresident</i>
Undergraduate students . . . . .	\$ 9.00**	\$33.00***
Graduate and professional students (Dentistry, Law, Medicine) . . . . .	14.00**	38.00***

\*Includes Athletics Fee \$8.25; Student Educational Services Fee \$4.00; Daily Athenaeum Fee \$1.50; Health, Counseling Service and Program Fee \$12.00; Mountainlair Construction Fee \$20.00; University Fee \$4.25.

\*\*Includes \$4.00 per semester hour Registration Fee.

\*\*\*Includes \$16.00 per semester hour Registration Fee.

Parkersburg Center of West Virginia University \$9.00 per semester hour for resident students; \$17.00 per semester hour for nonresident students.

Kanawha Valley Graduate Center (Nitro, W. Va.): \$14.00 per semester hour for resident students; \$38.00 per semester hour for nonresident students.

Laboratory Fees

Consult specific departmental sections of this *Catalog* for information concerning non-refundable laboratory fees, deposits, and microscope rental fee.



## SUMMER SESSION FEES

<i>Tuition, per semester hour</i>	<i>Resident</i>	<i>Nonresident</i>
Undergraduate students . . . . .	\$ 9.00*	\$33.00**
Graduate and professional students (Dentistry, Law, Medicine) . . . . .	14.00*	38.00**
Daily Athenaeum Fee†† . . . . .	1.00	1.00
Health, Counseling Service, and Program Fee† . . . . .	7.00	7.00
Mountainlair Construction Fee per summer term in excess of five weeks†† . . . . .	12.00	12.00
Mountainlair Construction Fee per five-week summer term or any portion thereof†† . . . . .	6.00	6.00
Student Educational Services Fee† . . . . .	2.00	2.00
University Fee† . . . . .	2.00	2.00

\*Includes \$4.00 per semester hour Registration Fee.

\*\*Includes \$16.00 per semester hour Registration Fee.

†Non-refundable fees required of full-time students. May be paid by part-time students who desire the services. Part-time students who elect to pay these fees must pay the same amount assessed full-time students.

††Fee required of all students. (Non-refundable unless student withdraws officially before the close of general registration).

<sup>5</sup>A full-time graduate student is one who is registered for 9 or more semester hours of work each semester of the regular academic year, 6 or more semester hours of work during the 10-week Summer Session, or 3 semester hours of work during a 5-week Summer Term. A full-time student during the academic year receives an Identification Card which entitles him to admission to all athletic events. A full-time student during the regular academic year or during the Summer Session is entitled to free medical consultation and advice from the University physician. A moderate charge is made for room calls, X-rays, special laboratory tests, drugs furnished by the University Pharmacy, minor operations, treatment of fractures and dislocations, and intravenous treatment.

<sup>6</sup>A part-time graduate student is one who is registered for fewer than 9 semester hours per semester during the regular academic year, or for fewer than 6 semester hours during the 10-week Summer Session, or for fewer than 3 semester hours during a 5-week Summer Term.

<sup>7</sup>No person shall be considered eligible to register in the University as a resident student who has not been domiciled in the State of West Virginia for at least twelve consecutive months next preceding college registration. No nonresident student may establish domicile in this State, entitling him to reduction or exemptions of tuition, merely by his attendance as a full-time student at any institution of learning in the State. A minor student whose parents acquire a West Virginia domicile after the student's original registration will be deemed to have the domicile of his parents and become entitled to pay resident fees. Moreover any student who has originally paid nonresident fees may become entitled to pay resident fees, if after an interim of non-attendance or otherwise he has established a valid legal domicile in this State at least twelve months prior to his registration in the University. In any event, the appointment of a guardian for a minor student temporarily resident in West Virginia, other than the designation of a natural guardian, shall not in and of itself operate to establish a West Virginia domicile for such student.

<sup>8</sup>The minimum rate for non-credit courses is that charged for one semester hour of credit.

<sup>9</sup>Tuition, Registration Fee, Athletics Fee, Student Educational Services Fee, Health, Counseling Service, and Program Fee, and University Fee. The Mountainlair Construction Fee and Daily Athenaeum Fee are non-refundable after the eighteenth day following the beginning of General Registration.

## Auditors

Students may enroll in courses without working for grade or for credit by registering as auditors and by paying full fees. Change in status from audit to credit or from credit to audit may be made during the registration period. Attendance requirements for auditors shall be determined by the instructor of the course being audited. It is the prerogative of the instructor to strike the name of any auditor from grade report forms and to instruct the registrar to withdraw the auditor from the class, if he should fail to meet such attendance requirements.

## Remission of Fees

The tuition fee and registration fee will be remitted to a person registered in the Graduate School or the College of Law and who is employed by the University on a regular appointment, subject to the following:

(a) There will be no remission of the Daily Athenaeum Fee or of the Mountainlair Construction Fee. These fees are charged all students, full-time and part-time, who are enrolled for regular courses of resident instruction.

(b) Except as provided in "c", a graduate teaching or graduate research assistant will receive remission of tuition fee and registration fee commensurate with the hours of service required by the terms of his appointment.

(c) A faculty member on full-time appointment at any recognized institution of higher learning located in West Virginia who is taking a course of graduate study at the University and holds an appointment as a graduate assistant will receive full remission of tuition and registration fees.

(d) A regular appointment must be effective at the beginning of a semester or summer session. Exemption from tuition fee and registration fee must be claimed at the beginning of the registration period or, in the case of a substitute appointment, within ten days after the appointment has been made.

(e) An employee who holds a regular appointment and is eligible for remission of tuition fee and registration fee in the second semester of any regular academic year is also eligible for remission of tuition fee and registration fee in the summer session immediately following his term of appointment.

In certain cases an employee on regular University appointment may be permitted to register as a full-time student in the Graduate School or the College of Law. If such an employee does register as a full-time student and qualifies for remission of tuition fee and registration fee, he shall not be subject to the Special Services Fee, except the Daily Athenaeum Fee and the Mountainlair Construction Fee, but must pay such fees to be entitled to the services provided thereby. Such employees do not receive the Student Identification Card which provides for athletic admissions, student educational services, health and counseling service, etc.

## University Employees

The spouse and dependent children of any person employed full-time by West Virginia University shall be charged the same fees as resident students provided the employee is living in West Virginia. The spouse and dependent children of full-time interns, residents, and fellows in the School of Medicine,

School of Dentistry, and University Hospital programs shall also be charged the same fee as resident students.

## Refunding of Fees

A student who officially withdraws from University courses may arrange for a refund of fees by submitting to the University Comptroller evidence of eligibility for a refund.

To withdraw officially from the University a student must apply to the Registrar for permission. Semester fees will be returned in accordance with the following schedule:

First refund period ending on the eighteenth day following the beginning of General Registration	} All Activity fees chargeable to Special Services and all other semester fees less \$2.50. (Under no circumstances is the amount retained less than \$2.50.)
Second refund period ending on the fifth Friday following the beginning of General Registration	} 70% of all refundable fees*
Last refund period ending on the eighth Friday following the beginning of General Registration	} 40% of all refundable fees*

The second Friday following the beginning of General Registration for a summer session or a summer term is the end of the refund period.

No part of the Activity Fee is refundable unless the student withdraws from the University.

University policy provides that students called to the armed services of the United States may be granted full refund of refundable fees, but no credit, if the call comes before the end of the first three-fourths of the semester, and that full credit by courses be granted to men called to the armed services of the United States if the call comes thereafter; provided, however, that credit as described above will be granted only in those courses in which the student is maintaining a passing mark at the time of his departure for military service. In the recording of final grades, for three-fourths of a semester or more, both passing and failing grades are to be shown on the student's permanent record card.

## Service Charge on Returned Checks

A service charge of 5 per cent of the amount of each check returned unpaid by the bank upon which it is drawn shall be collected unless the student can obtain an admission of error from the bank.

If the check returned by the bank was in payment of University and registration fees, the Comptroller's office shall declare the fees unpaid and registration cancelled if the check has not been redeemed within three days from date of written notice. In such a case the student may be reinstated upon redemption of the check, payment of the 5 per cent service charge, Reinstatement Fee of \$3.00, and Late Payment Fee of \$10.00.



# Part IV / Courses of Study

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## ABBREVIATIONS

I—a course given in the first semester.

II—a course given in the second semester.

I, II—a semester course given in each semester.

I and II—a course given throughout the year.

S—a course given in the Summer Session.

hr.—number of credit hours per course.

rec.—recitation period.

lab.—laboratory period.

conc.—concurrent registration required.

PR.—prerequisite.

consent—consent of instructor required.

NOTE: Summer courses carry the same credit value as courses offered in the regular semesters.

## PLAN FOR NUMBERING COURSES

For convenience each course of study is designated by the name of the department in which it is given and by the number of that course. The plan for numbering is as follows:

Courses 200 to 299—Courses for advanced undergraduate students and selected graduate students. No more than 25 per cent graduate student enrollees permitted in any class carrying 200 course number. No more than 40 per cent of 200-level course credits can be counted toward meeting requirements of any graduate degree.

Courses 300 to 399—Courses for graduate students; students in professional programs leading to the doctorate; and selected, advanced undergraduates. The latter may not exceed 20 per cent in any class carrying a 300 course number, must have a 3.0 cumulative grade-point average, and must have the written approval, on special forms, of their instructor, their adviser, and the Graduate School Dean. Seniors within 10 semester hours of graduation may, with the prior approval, on special senior petition forms, of advisers and the Graduate School Dean enroll in 300-level graduate courses.

(In summary, 300-level courses are intended primarily to serve the introductory graduate or master's degree course needs. Graduate degree credit hour requirements must include at least 60 per cent of the total at the 300 and 400 level.)

Courses 400 to 499—Courses for graduate students only. All doctor's degree dissertation hours shall be awarded at the 400 level—specifically under course number 497. Graduate degree credit hour requirements must include at least 60 per cent at the 400 and 300 level.

# College of Agriculture and Forestry

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## AGRICULTURE

### The Degree of Master of Agriculture

In general, the requirements for and the regulations governing the granting of this degree are the same as those for the Master of Science. A minimum total number of 30 credit hours, including the three for the problem report, is required. Specific requirements for the degree of Master of Agriculture are:

1. Candidates for the degree of Master of Agriculture shall have previously completed requirements for the degree of Bachelor of Science in Agriculture or its equivalent.

2. A problem report (rather than a research thesis) on some phase of agriculture shall be required. A maximum of 3 semester hours of credit may be allowed for the problem report, which must be approved by the student's committee. The candidate must submit an outline for his problem report to his committee prior to the completion of the first 12 hours of credit applicable to this degree.

3. The program of work shall be such that emphasis will be on breadth of knowledge in the field of agriculture rather than upon one narrow field of science. To insure such breadth of training, the student must take at least three credit hours of work in at least four subject-matter groups within the Division of Agriculture. A maximum of 12 credit hours exclusive of the problem report, will be accepted in any subject-matter group or administrative department. The subject-matter groups from which the student may select courses are:

1. Agricultural Economics, Agricultural Education
2. Agricultural Mechanics
3. Animal Science
4. Bacteriology, Entomology
5. Agricultural Biochemistry, Genetics
6. Food Science
7. Landscape Architecture
8. Plant Sciences (Agronomy, Horticulture, and Plant Pathology)
9. Soil Science

A maximum of 10 credit hours taken in other divisions of the College of Agriculture and Forestry or in other colleges of the University may apply toward meeting the total credit-hour requirement.

### Agriculture

200. **Agricultural Travel Course.** S. 6 hr. Tour and study of production methods in major livestock and crop regions of the United States and other countries. Influence of population, climate, soil, topography, markets, labor, and other factors on agricultural production.
360. **Problem Report for the Degree of Master of Agriculture.** I, II, S. 1-3 hr.

## AGRICULTURAL BIOCHEMISTRY

The Faculty of Agricultural Biochemistry, an interdivisional faculty group within the College of Agriculture and Forestry, is responsible for the planning and conduct of course offerings in Agricultural Biochemistry and the graduate degree programs in Agricultural Biochemistry.

In addition to meeting the requirements for admission to the Graduate School, applicants for admission to the graduate degree programs in Agricultural Biochemistry must have at least a grade-point average of 2.5 in the following courses: general, analytical, organic, and physical chemistry. An applicant who does not present all the chemistry requirements may be admitted provided the Faculty of Agricultural Biochemistry feels that existing deficiencies in chemistry may be removed within one year.

### The Degree of Master of Science

Work for the degree of Master of Science consists chiefly of course offerings selected according to the special needs of the student from 300 and 400 courses in agricultural biochemistry, medical biochemistry, chemistry, statistics, and the biological sciences. A total of no fewer than 30 hours of graduate credit is required of which no more than 6 may be for research. A thesis is required.

### The Degree of Doctor of Philosophy

Applicants for the degree of Doctor of Philosophy must pass comprehensive written and oral examinations in biochemistry and one or two minor fields. The applicant does not become a candidate for the degree until he has satisfied the foreign language requirement and passed the comprehensive examination.

#### Agricultural Biochemistry

##### Agr. Biochem.

- 210. **Introductory Biochemistry.** I. 3 hr. PR: Two semesters of General Chem. and one semester of Organic Chem. The biochemistry of the proteins, carbohydrates, lipids, nucleic acids, enzymes, coenzymes, and cellular metabolism in plants and animals.
- 212. **Animal Biochemistry.** II. 3 hr. PR: One semester of Biochemistry. Nutritional and physiological chemistry of domestic animals.
- 213. **Introductory Biochemistry Laboratory.** II. 2 hr. PR or conc.: Agr. Biochem. 210. A laboratory course in nutritional biochemistry.
- 310. **General Biochemistry.** I. 3 hr. PR: Organic Chem. 8 hr., quantitative analysis and consent. A general course in biochemistry primarily intended to meet the needs of graduate students.
- 311. **Laboratory Experiments in Biochemistry.** I. 2 hr. PR or conc.: Agr. Biochem. 310. Experiments to demonstrate certain phases of the subject matter covered in General Biochemistry.
- 312. **General Biochemistry.** II. 3 hr. PR: Agr. Biochem. 310 or consent. A continuation of Agr. Biochem. 310.
- 313. **Advanced Biochemistry Laboratory.** II. 2 hr. PR: Agr. Biochem. 311 and concurrent registration in Agr. Biochem. 312. Application of modern biochemical techniques to experimentation in animal and plant metabolism.



314. **Radionuclide Biochemistry.** II. 3 hr. PR: Chem. 1, 2, 131, or consent. Radionuclide methods and isotope handling as needed by students interested in biological research.
410. **Biochemistry of Carbohydrates.** II. 3 hr. PR: Agr. Biochem. 312. The structure, properties and metabolism of sugar and polysaccharides.
412. **Lipid Biochemistry.** I. 3 hr. PR: Agr. Biochem. 312, and consent. A consideration of the chemical and physical properties of the various classes of lipids and their biochemical and physiological pathways within the cell and cellular particulates.
414. **Enzymes.** II. 3 hr. PR: Agr. Biochem. 312, or consent. A general survey of the chemistry enzymes for the advanced student.
416. **Vitamins.** I. 2 hr. PR: Agr. Biochem. 312 or consent. Identification, nomenclature and chemical structures, biochemical systems, biogenesis, pathology and requirements of vitamins and vitamin like compounds. Offered in Fall of odd years.
418. **Mineral Metabolism.** I. 3 hr. PR: Agr. Biochem. 312 or consent. The inorganic and biochemistry of the minerals in the body and the physiological function of minerals are studied. A special term paper is required of each student on the chemical metabolism studies. Offered in Fall of even years.
420. **Special Topics.** I, II, S. 2-4 hr. Advanced training will be provided through literature surveys and special research projects, in such areas as biochemical techniques, animal nutrition and metabolism.
422. **Plant Biochemistry.** I. 3 hr. PR: Agr. Biochem. 312 or equiv. An advanced treatment of the composition and metabolism of plants. Offered in Fall of odd years.
450. **Seminar.** I, II. 1 hr. per sem.
497. **Research.** I, II, S. 1-15 hr.

## **DIVISION OF ANIMAL AND VETERINARY SCIENCES**

The Division offers Master of Science programs in two areas—Animal Science and Animal Nutrition—and a Doctor of Philosophy program in Animal Nutrition. The division participates in interdepartmental Doctor of Philosophy programs in Agricultural Biochemistry, Genetics, and Reproductive Physiology.

The Master of Science program in Animal Science allows maximum flexibility in courses and research problems. Students may work with beef and dairy cattle, sheep, swine, poultry, rats, mice, and meadow voles. They may emphasize physiology, pathology, production, breeding, nutrition, or food products. Research problems in farm animals form the basis for many studies, but the comparative approach is emphasized.

Admission requirements are similar to those in other biological sciences. The student should have completed basic courses in the physical and biological sciences, including genetics, nutrition, and physiology. For the programs in Animal Nutrition, analytical chemistry and organic chemistry (one year) are required. Deficiencies may prolong the time needed to complete degree programs.

Twenty-four approved hours of course work and a thesis are required for all Master of Science degrees. The doctoral programs are governed by the general regulations of the Graduate School.

## Animal Industry and Veterinary Science

### AIVS

420. **Special Topics.** I, II, S. 1-4 hr. (1 hr. credit in special cases only). Advanced study in particular phases of such animal science topics as animal production, nutrition, physiology, breeding and genetics, veterinary science, and food science. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
470. **Methods of Animal Research.** I. 3 hr. Design, experimental procedures, and analyses used in research in the several areas of animal science. Offered in odd years.

### Animal Breeding and Genetics

212. **Poultry Breeding.** II. 3 hr. PR: Course in Genetics or consent. Breeding techniques specific for genetic improvement of economic traits in poultry. Offered in odd years.
226. **Breeding of Farm Animals.** I. 3 hr. PR: Course in Genetics or consent. Application of principles of quantitative genetics to the improvement of farm animals.
426. **Advanced Animal Selection.** II. 3 hr. PR: Course in Statistics and course in Genetics or equiv. An advanced course dealing with the basic concepts of experimental and statistical approaches in the analysis of quantitative inheritance with special reference to the magnitude and nature of genotypic and non-genotypic variability. Offered in even years.
450. **Seminar.** I, II. 1 hr. per sem.
497. **Research.** I, II, S. 1-15 hr.

### Animal Nutrition

#### An. Nutr.

294. **Poultry Nutrition.** II. 3 hr. PR: An. Nutr. 101. Nutritional requirements, nutrient interrelationships, and nutritional deficiencies of all types of domesticated fowl.
301. **Principles of Nutrition and Metabolism.** I. 3 hr. PR: Agr. Biochem. 210, An. Physiol. 100, or equiv. A basic course in animal nutrition.
305. **Comparative Nutrition and Metabolism.** II. 3 hr. PR: An. Nutr. 301 or consent. A comparative study of the utilization of dietary nutrients by species of laboratory and domestic animals and man. Offered in odd years.
306. **Nutrition Laboratory Methods.** I. 3 hr. PR: An. Nutr. 301 or concurrent registration. Chemical, physical, and biological methods used in animal nutrition research.
407. **Advanced Nutrition and Metabolism.** I. 3 hr. PR: Agr. Biochem. 311 or consent. Advanced treatment of the nutrition, metabolism, nutrient interrelationship, and metabolic regulatory mechanisms of domestic animals.
409. **Nutrition and Physiology of the Ruminant.** I. 3 hr. PR: An. Physiol. 100; An. Nutr. 101; Agr. Biochem. 310. A study of the nutritional and physiological processes peculiar to the ruminant animal. Offered in even years.
411. **Problems in Nutritional Physiology.** I. 3 hr. PR: An. Nutr. 305 or consent. Consideration of the interrelation of nutrition with growth, reproduction, environment, disease, and related areas. Offered in even years.
450. **Seminar.** I, II. 1 hr.
497. **Research.** I, II, S. 1-15 hr.

## Animal Physiology

### An. Physiol.

204. **Animal Physiology Laboratory. I.** 2 hr. PR: An. Physiol. 100 or concurrent registration. Laboratory study of the physiological systems of animals and the influence of environment on these systems.
225. **Physiology of Reproduction. II.** 3 hr. PR: Course in Biology. Comparative physiology of reproduction in higher animals; endocrine functions involved in reproduction; genetic and environmental variations in fertility mechanisms.
227. **Milk Secretion. II.** 3 hr. (1 lab.). PR: Course in Animal Physiology. The evolution, anatomy, and growth of the mammary gland. The chemical, hormonal, physiological, and environmental factors affecting lactation. Offered in odd years.
280. **Behavioral Patterns of Domestic Animals. II.** 3 hr. (1 lab.). Examination of the bases for and exhibition and control of behavioral patterns of domestic animals.
425. **Endocrinology of Reproduction. II.** 4 hr. (2 labs.). PR: An. Physiol. 225 or Zool. 272 or equiv. Discussion of and laboratory experience in classical current concepts of hormonal and neurohormonal regulation of reproductive phenomena with emphasis on species differences and similarities.
450. **Seminar. I, II.** 1 hr.
497. **Research. I, II, S.** 1-15 hr.

## Animal Production

### An. Prod.

240. **Advanced Poultry Production. I.** 3 hr. Special phases of broiler and egg production, disease control, laborsaving studies, and recent designs in housing and equipment for all types of poultry. Offered in even years.
250. **Current Literature in Animal Science. I, II, S.** 3 hr. (1 lab.). PR: An. Nutr. 101. Evaluation of current research in animal science and its application to production and management.
422. **Advanced Milk Production. II.** 3 hr. PR: An. Nutr. 101 or consent. Advanced study of the feeding, breeding, and management of dairy cattle. Offered in odd years.
450. **Seminar. I, II.** 1 hr.
497. **Research. I, II, S.** 1-15 hr.

## Food Science

### Food Sci.

- 267.\* **Advanced Meats. II.** 3 hr. (2 labs.). PR: Food Sci. 167. Studies covering composition of meat, complete fabrication of meat animal carcasses, factors influencing yield, physiology, and chemistry of pertinent phenomena, and merchandising of meat. Offered in even years.
312. **Critical Evaluation of Recent Research and Developments in Dairy Foods. I.** 4 hr. (2 labs.). PR: Consent. Normally a minimum of Bact. 247 and at least one dairy foods course will be required. Methods, results, and impact of recent research and developments pertaining to dairy food industry. Offered in even years.
450. **Seminar. I, II.** 1 hr.
497. **Research. I, II, S.** 1-15 hr.

\*Transportation for required trips in connection with this course will generally be supplied by the College. Students will be responsible for their meals and lodging.



## Veterinary Science

### Vet. Sci.

- 210. **Principles of Laboratory Animal Science.** II. 3 hr. (1 lab.). PR: Consent for undergraduates. The management, genetics, physiology, nutrition, disease, and germ-free quartering of the common laboratory animals.
- 301. **Surgery.** (Same as Surg. 301). I. 3 hr. (1 lab.). Introduction to laboratory animal experimentation.
- 305. **Parasites and Pathology.** II. 3 hr. PR: Course in Biology. Common parasites of farm animals, their control, and their effect upon the host. Offered in odd years.
- 450. **Seminar.** I, II. 1 hr.
- 497. **Research.** I, II, S. 1-15 hr.

## DIVISION OF FORESTRY

The Division of Forestry offers graduate study leading to the degrees of Master of Science in Forestry and Master of Science. Students seeking the Master of Science in Forestry degree may major in forest ecology, forest economics, forest genetics, forest hydrology, forest management, forest protection, forest recreation, silviculture, or wood industries. Students who wish to obtain the Master of Science degree may major in wildlife management, recreation, or wood science.

Applicants for graduate work in the Division of Forestry must have as a minimum requirement a bachelor's degree, with appropriate background in the subject matter area of his major field.

A candidate for the degree of Master of Science in Forestry, or Master of Science with a major in wildlife management or wood science, must pass satisfactorily 30 credits of approved work, 6 of which credits shall constitute a thesis.

A candidate for the degree of Master of Science with a major in recreation has the option of earning the degree on the basis of 30 hours with a thesis or 36 hours without a thesis.

### Forestry

#### For.

- 219. **Forest Hydrology.** II. 3 hr. PR: Consent. Description and quantitative treatment of the hydrologic cycle in nature, with primary emphasis on the role of forest and the principles of silvicultural water management.
- 220. **Forest Policy and Administration.** II. 3 hr. (For upperclassmen only). Forest policy in the United States; important federal and state laws; administration of public and private forests; problems in multiple-use forestry.
- 226. **Remote Sensing of Environment.** II. 2 hr. PR: Math. 3 and Math. 4. Principles of measurement and interpretation of natural resources and environment from photography, radar, infrared, and microwave imagery.
- 233. **Principles of Industrial Forestry.** I. 3 hr. PR: Senior standing or consent. Analysis and case studies of problems pertinent to the integration of wood conversion technology with principles of production, marketing, and management.

319. **Microclimatology.** II. 3 hr. PR: Consent. A description and quantitative treatment of climate near the ground in terms of physical and physiological processes of energy and mass exchange.

## **Forest Management**

### **F.M.**

211. **Silvicultural Systems.** I. 4 hr. PR: F.M. 12. Principles of regeneration cuttings, intermediate cuttings, and cultural operations, with their application to forest stands.
213. **Regional Silviculture.** I. 2 hr. PR: F.M. 12; PR or conc: F.M. 211. Major forest types of the United States—their composition, management, problems, and silvicultural treatment.
215. **Principles of Artificial Forestation.** II. 3 hr. PR: F.M. 12. Seeding and planting nursery practice; phases of artificial regeneration.
216. **Forest Genetics and Tree Improvement.** I. 3 hr. PR: Genet. 272 or equiv., or consent. A study of forest genetic principles and their application to forest tree improvement including crossing methods, selection systems, and other tree improvement techniques.
222. **Forest Mensuration.** II. 3 hr. PR: F.M. 122. The measurement of growth and yield; statistical methods applied to forest measurement problems.
230. **Principles of Forestry Economics.** II. 3 hr. PR: Econ. 51 and 52 or equiv. The economics of production, distribution, and use of forest goods and services. Emphasis is on analytical methods and techniques in dealing with forest economic problems.
232. **Forest Finance.** II. 2 hr. PR: Junior standing. Interest, discount, and rate earned in forest production and exploitation. Particular reference to the problems of forestry such as determining the value of standing timber, the appraisal of forest damages, and forest taxation.
233. **Forest Management.** I. 4 hr. PR: Summer Camp; PR or conc: F.M. 211. The principles of sustained yield forest management. Organization of the forest area, selection of management objectives, application of silvicultural systems, and regulation of the cut. The forest management plan.
234. **Forest Management Plans.** II. 2 hr. PR: F.M. 233. Analyses of forest management plans. Construction of a sustained yield timber management plan for a specific forest tract.
330. **Advanced Principles of Forestry Economics.** I. 3 hr. PR: Econ. 51 and 52 or equiv.; F.M. 230 or equiv. Intensive study of both micro- and macro-economics of forestry.
411. **Environmental Relationships in Hardwood Forests.** I. 3 hr. PR: F.M. 211. The study of environmental factors affecting establishment, composition, and growth of hardwood forests.
412. **Silvicultural Practices for Hardwood Forest Types.** II. 3 hr. PR: F.M. 211, 213. Designing proper silvicultural systems for managing Appalachian hardwood stands; reconstructing stand histories, recognizing problems, and prescribing appropriate silvicultural treatment.
431. **Advanced Forest Regulation.** I, II. 2 hr. PR: F.M. 233 or equiv. An intensive study of area and volume regulation suitable for applied forestry in the United States.
470. **Special Topics.** I, II. 1-6 hr. per sem. PR: Consent. (For the Master of Science Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).

472. **Seminar in Silviculture.** I, II. 1 hr. per sem.; max. credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of silviculture with emphasis on hardwood forest types.
497. **Research.** I, II, S. 1-15 hr.

## Wood Science

### W.S.

231. **Wood Finishing.** I. 3 hr. PR: W.S. 121 or consent. A technical course in wood finishing covering surface preparation, composition of finishing materials, equipment, techniques, defects, troubleshooting, and quality control.
232. **Theory and Practice of Wood Adhesion.** I. 3 hr. PR: W.S. 123, 141, or consent. Detailed theoretical introduction and examination of different types of adhesives and gluing techniques used in the wood industry.
234. **Statistical Quality Control.** II. 3 hr. PR: W.S. 134 or consent. A study of methods used to control quality of manufactured wood products. Control charts of variables and attributes. Acceptance sampling techniques.
240. **Wood Moisture Relationships.** II. 3 hr. PR: W.S. 123. A study of the principles involved in the relation between wood and moisture, and purposes, effects, and methods of seasoning.
251. **Forest Products Protection.** II. 3 hr. PR: W.S. 123, 134, or consent. A study of the biological organisms responsible for the deterioration of wood products, their control by preservative methods, and a study of fire retarding methods.
261. **Mechanical Properties of Wood.** I. 3 hr. PR: T.A.M. 102. Properties and behavior of wood as a structural material.
320. **Wood Microstructure.** I. 3 hr. PR: W.S. 123, senior standing, or consent. A detailed examination of wood microstructure as it relates to processing, behavior, and identification.
473. **Seminar in Wood Utilization.** I, II. 1 hr. per sem.; max. credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of wood utilization.

## Wildlife Management

### W.M.

213. **Wildlife Ecology.** I. 4 hr. PR: Biol. 1 and 2. Basic principles of ecology and their application to wildlife. Field and laboratory studies of major ecosystems important to wildlife, including management of these ecosystems for wildlife.
224. **Forest Zoology.** II. 3 hr. PR: Biol. 2. The relationship of mammals, birds, reptiles, amphibians, and fish to the forest, with emphasis on the ecology and taxonomy of these groups.
231. **Wildlife Techniques.** II. 3 hr. PR: W.M. 131 or 213, Bot. 161 or consent. Field and laboratory techniques necessary in the management and study of wildlife; collection of field data, mapping, censusing, habitat evaluation, literature, and reports are stressed.
234. **Principles of Wildlife Management.** II. 3 hr. PR: W.M. 213 or consent. A survey of the major game animals and the problems and principles involved in their management.
312. **Wildlife Population Ecology.** I. 3 hr. PR: W.M. 131 or equiv.; Stat. 211 or equiv. Theory of population growth, population change, intraspecific and interspecific relationships that are involved in the natural regulation of population and the effects of exploitation on wildlife populations.



370. **Wildlife Seminar. II.** 1 hr. per sem.; max. credit 4 hr. PR: Consent. Discussion of current developments in wildlife management.
434. **Ecology and Management of Upland Wildlife. II.** 4 hr. PR: Consent. Ecology and management of upland game birds and mammals, with emphasis on recent literature.
436. **Ecology and Management of Wetland Wildlife. II.** 4 hr. PR: Consent. Ecology and management of waterfowl and wetland furbearers with emphasis on recent research and management literature.

## Recreation and Parks

### R.P.

202. **Field Work.** 3 hr. Recreation majors are required to have at least 8 weeks of supervised recreation leadership field work, usually during summer following junior year and after completion of upper-level recreation courses. Arrangements under the direction of chairman.
233. **Park Management. I.** 3 hr. PR: Junior standing. Introduction to administration and management problems associated with provision of recreation in parks under both private and public control.
251. **Recreation Leadership. I.** 3 hr. Meaning of leadership, its application to the field of recreation, and analysis of techniques. Examination of social group work method and its application, particularly in national youth organizations.
263. **Program Planning. II.** 3 hr. PR: R.P. 1. Fundamentals for general program planning; considering needs, facilities, age groups, local customs, climatic factors, etc. Planning involved in playgrounds, indoor centers, playfields, parks, hospitals, voluntary agencies, industry, and camps.
265. **Functional Planning of Recreation and Park Facilities. II.** 3 hr. Lecture and workshop. Problems and principles governing the planning for functional and effective usage of facilities in recreation. Emphasis on playgrounds, playfields, indoor centers, parks, camps, and swimming pools.
271. **Administration of Camping Services. II, S.** 3 hr. PR: R.P. 40 or equiv. or consent. Principles involved in modern camping programs; organization and administration of camps.
316. **Philosophy of Recreation. II, S.** 3 hr. PR: Consent. Interpretation of recreation as a basic part of the living process; importance to individual community and national welfare; and social and economic significance.
324. **Outdoor Recreation in Our Modern Society.** 3 hr. PR: For persons in fields of recreation, park, outdoor education and conservation, or by consent. Interpretation as to what it is, what people do, where they go, how this affects our economic, social, and cultural life, and significant trends.
335. **Administration of Recreation. I, S.** 3 hr. PR: Major in recreation or consent. General principles of administration; organization of staff administrative procedures. Study of enabling laws, legal responsibilities, surveys, finance, programs, facilities, and public relations.
348. **Outdoor Education and School Camping.** 3 hr. PR: For majors in education, recreation, extension, forestry, or by consent. Course designed to meet the needs of schools, colleges, and other education and conservative agencies interested in developing outdoor education programs. Emphasis is upon interpretation and programming of the outdoor education concept.
408. **Practicum in Recreation. I, II, S.** 4 hr. PR: R.P. 472, PESE 396 and 397. Program planning, curriculum development, and job functions in recreation.
415. **Leisure and Recreation. I, S.** 3 hr. PR: Consent. Study of leisure as a social phenomenon in our modern culture and its implications for recreation.

421. **Human Interest Areas in Recreation Planning.** I, II, S. 3 hr. PR: R.P. 316 or 20 hr. in Education or equiv. Exploration of the human interest areas which are the sources of recreation program content. Their adaptation to school and municipal recreation program planning.
462. **Community Recreation.** I, S. 3 hr. PR: R.P. 316 or consent. A study of problems related to the provision of adequate recreation services for a community. Standards and quality of recreation service; methods of measuring existing services and their coordination; and community organization procedures. Course is designed for leaders in voluntary agencies, schools, churches, and municipal recreation organizations.
472. **Seminar in Recreation.** I, II, S. 4 hr. PR: R.P. 316. An overview and critical analysis of the literature and research in recreation.
497. **Research.** I, II, S. 1-15 hr.

## **DIVISION OF PLANT SCIENCES**

### **Agronomy and Genetics**

The Committee of Agronomy and Genetics offers the degrees of Master of Science and Doctor of Philosophy with majors in crops, soils, and genetics.

Adequately equipped laboratories, greenhouse, and growth chambers are available. Several experimental farms are available for field investigations.

To enter graduate work, the student must have adequate background in the physical and biological sciences in addition to basic courses in crop science, genetics, or soil science. Students who have not had these basic courses will be required to take them without credit early in their graduate program. In addition to courses in their major field of study, students will be expected to study in one or more related fields with the course selection dependent upon the field of interest.

The course schedule for graduate study will be developed in consultation with the student's adviser and will include certain designated requirements for each curriculum.

A thesis or problem report and a final examination are required for the Master of Science degree. Requirements for the Doctor of Philosophy degree are as outlined by the Graduate School.

#### **Agronomy (Crop Science)**

##### **Agron.**

250. **Turfgrass Management.** I. 3 hr. PR: Agron. 2, or consent. The establishment, maintenance, and adaptation of grasses and legumes for lawns, golf courses, parks, athletic fields, and roadsides. An understanding of turfgrass management will be developed by associating differential plant responses with soil, climatic, and biotic factors that influence plant species growth, selection, and adaptation. Offered in Fall of even years.
251. **Weed Control.** I. 3 hr. PR: Plant Sci. 52 and Agron. 2, or consent. Fundamental principles of weed control. Recommended control measures for and identification of common weeds. 2 lec., 1 lab. Offered in Fall of odd years.
252. **Grain and Special Crops.** I. 3 hr. PR: Plant Sci. 52 and Agron. 2, or consent. Advanced study of methods in the production of grain and special crops. Varieties, improvement, tillage, harvesting, storage, and uses of crops grown for seed or special purposes. Offered in Fall of even years.

254. **Pasture and Forage Crops.** II. 4 hr. PR: Plant Sci. 52 and Agron. 2, or consent. All phases of pasture and forage crop production, including identification, seeding, management, use, seed production, and storage of forage crops. 3 lec., 1 lab.

#### **Agronomy (Soil Science)**

210. **Soil Fertility.** I. 3 hr. PR: Agron. 2 or 10. Soil properties in relation to fertility and productivity of soils; evaluation of soil fertility; production of fertilizers and their use in increasing the fertility and productivity of soils.
212. **Soil Conservation and Management.** II. 3 hr. PR: Agron. 2 or 10. Using soil technology to solve soil management problems relating to cropping systems. Field diagnosis of soil problems will be stressed. Two half-day visits. Offered in Spring of odd years.
230. **Soil Physics.** II. 3 hr. PR: Agron. 2 or 10. Physical properties of soils, water and air relationships and their influence on soil productivity. Offered in Spring of even years, 2 lec., 1 lab.
301. **Geotechnic.** I. 3 hr. PR: Consent. A presentation of a unified approach to the various aspects of soil formation and the influence of the formative factors on the nature of soils and their use as engineering materials. This course will serve as a common meeting ground for students in the various disciplines concerned with earth science. 3 lec. Offered in the Fall of odd years.
315. **Soil Genesis and Classification.** I. 3 hr. PR: Agron. 2 or 10. Origin and formation of soils. Study of soil profiles and soil forming processes in the field and laboratory. Principles of classification and techniques of soil mapping. 2 lec., 1 lab. Offered in Fall of even years.
321. **Identification of Clay Minerals in Soils.** II. 3 hr. PR: Physical Chemistry or consent. Characterization of clay minerals is becoming an important aspect of research and practical application in the areas of soil, geology, civil engineering, and related fields. This course will provide a vehicle for these various disciplines to study the methods used in qualitative and quantitative identification of these secondary minerals. 1 lec., 2 lab. Offered in Spring of even years.
410. **Advanced Soil Fertility.** II. 3 hr. PR: Agron. 210, Bot. 171 or consent. The influence of soil chemical and physical properties or availability of plant nutrients, intensive study of individual plant nutrients; and interactions of nutrients in soils and crops. Offered in Spring of odd years.
416. **Soil Chemistry.** I. 3 hr. PR: Consent. Chemistry of soil development; chemical and mineralogical composition of soils; nature and properties of organic and inorganic soil colloids; soil acidity; cation and anion exchange phenomena; soil chemistry of macro- and micro-nutrients.
418. **Chemistry of Soil Organic Matter.** II. 3 hr. PR: Agron. 210 or consent. The chemical composition of soil organic matter will be studied in relation to its physico-chemical properties and human formation. Methods involving extraction. Fractionation and purification of soil organic components will be examined. 2 lec., 1 lab. Offered in Spring of even years.

#### **Agronomy (Crop and Soil Science)**

420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree. Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
450. **Seminar.** I, II. 1 hr. per sem. Recent literature pertaining to soil and crop production.
497. **Research.** I, II. 1-15 hr.



## Genetics

### Genet.

272. **Principles of Genetics.** II. 4 hr. PR: 8 hr. of biological science. The fundamentals of inheritance.
290. **Crop Breeding.** II. 3 hr. PR: Genet. 272 or 321. Methods and basic scientific principles involved in the improvement of leading cereal and forage crops through hybridization and selection. Offered in Spring of odd years.
321. **Basic Concepts of Modern Genetics.** I. 3 hr. PR: 8 hr. of biological science and 1 year of chemistry. Independent inheritance, linkage. Chemical nature of genetic material. Control of phenotype by genetic material. Gene action and coding of genetic material.
324. **Cytogenetics.** II. 4 hr. PR: Genet. 272 or 321, and Biol. 215 or consent. Emphasis is put upon macromolecules that carry information of the chromosomes, cell division, and the cytological and molecular basis of genetics. Special attention is given to cytogenetics of genomes and chromosome morphology and the evolution of these. Offered in Spring of odd years.
325. **Human Genetics.** I. 3 hr. PR: Genet. 272 or 321 or consent. A study of the genetic system responsible for the development of phenotype in man.
335. **Population Genetics.** I. 3 hr. PR: Genet. 272 or 321, or consent. The relationship of gene and genotype frequencies in populations of diploid organisms, and the effects of mutation, migration, selection, assortive mating, and inbreeding, in relation to single gene pairs. Application of these concepts to the multigenic inheritance of quantitative traits. Offered in Fall of even years.
390. **Genetic Mechanisms of Evolution.** II. 2 hr. PR: Genet. 272 or equiv. The genetic mechanisms which result in evolutionary change. The origin of life, origin and organization of genetic variability, differentiation of populations, isolation and speciation role of hybridization and polyploidy, and origin of man. Offered in Spring of even years.
420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
426. **Advanced Biochemical Genetics.** II. 3 hr. PR: Genet. 272 or 321 and Organic Chemistry. Physiological and biophysical concepts of genetic material. Structure and arrangement of genetic units. Nucleic acids as carriers of genetic information. Gene action and amino acid coding. Biochemical evolution of genetic material. Offered in Spring of even years.
450. **Seminar.** I, II. 1 hr. per sem. Recent literature pertaining to breeding, genetics, and cytology.
497. **Research.** I, II. 1-15 hr.

## Horticulture

The Committee of Horticulture offers a Master of Science program in the various aspects of Horticulture and in the Institute of Biological Sciences participates in a Doctor of Philosophy program in Plant Physiology. To enter graduate work the student should have basic courses in the physiological and biological sciences in addition to basic courses in Genetics, Soils, and Plant Physiology. Students who have not had such courses will be required to take these early in their graduate work.

The candidate for the degree of Master of Science should offer a minimum of 30 semester hours properly distributed among the related sciences and his major field. The doctoral program is covered by the general regulations of the Graduate School and the faculty of Plant Physiology.

## Horticulture

### Hort.

- 204. **Plant Propagation.** II. 3 hr. A study of the practices of plant propagation and the factors involved in reproduction in plants.
- 229. **Landscape Design.** I. 3 hr. (1 lec., 1 scheduled lab., 1 arranged lab.). A course in ornamental horticulture giving an appreciation of the basic principles of design and information pertaining to the use and care of ornamental plants around the home.
- 242. **Small-Fruits.** I. 3 hr. (2 lec., 1 scheduled lab.). PR: Plant Sci. 52, Hort. 107, or consent. The taxonomic, physiological, and ecological principles involved in the production and handling of small-fruits.
- 243. **Physiology of Vegetables.** I. 3 hr. (2 lec., 1 scheduled lab.). PR: Plant Sci. 52. Physiological and ecological principles involved in the production of vegetable crops.
- 244. **Handling and Storage of Horticultural Crops.** II. 3 hr. (2 lec., 1 scheduled lab.). PR: Plant Sci. 52, Chem. 16. Characteristics of perishable crops. Methods and materials employed to maintain quality.
- 245. **Greenhouse Management.** II. 3 hr. The greenhouse as a controlled plant environment. A study of how to manipulate factors influencing plant growth and development within the specialized environments of greenhouses.
- 301. **Post-Harvest Physiology.** II. 3 hr. (1 lec., 2 labs.). Physiology and biochemistry of harvested crops.
- 420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
- 450. **Seminar.** I, II. 1 hr. (1 seminar). Recent literature in the plant sciences which pertains to horticultural science.
- 497. **Research.** I, II, S. 1-15 hr.

## Entomology

### Entomol.

- 204. **Principles of Entomology.** I. 4 hr. PR: Biol. 1 and 2 or equiv. A course concerned with the control and maintenance systems in insects emphasizing anatomy, morphology, physiology, reproduction, and systematics.
- 313. **Insect Transmission of Plant Disease.** I. 3 hr. PR: Plant Path. 153 and 201. Role of insects in spread and development of plant diseases. Offered in Fall of odd years.
- 420. **Special Topics.** I, II, S. 2-6 hr. PR: Entomol. 202. Advanced study of entomological topics of special interest to the student.
- 450. **Seminar.** I, II. 1 hr. per sem.
- 497. **Research.** I, II, S. 1-15 hr.

## Plant Pathology and Bacteriology

Graduate students in Plant Pathology or Bacteriology must hold a Bachelor's degree from an approved college. To enter into graduate work without condition in these fields the student must have an adequate background of approved courses in biology or agriculture. Additional undergraduate work in chemistry, physics, mathematics, or botany may be required according to the needs of the field of specialization followed by the student. Admission to can-

didacy is conditioned upon a suitable period in residence and demonstrated ability to do work of graduate caliber.

A candidate for the Master's Degree in Plant Pathology or Bacteriology must pass satisfactorily 30 credits of approved work of which 6 may be for a thesis. A thesis is required.

The doctorate is offered only in Plant Pathology and Agricultural Microbiology and candidates for these degrees are governed by the general regulations of the Graduate School.

### **Agricultural Bacteriology**

#### **Agr. Bact.**

- 347. **Food Microbiology.** I. 4 hr. PR: Bact. 141, organic chemistry or consent. The ecology and physiology of microorganisms important in the manufacture and deterioration of foods, and the techniques for the microbiological examination of foods. Offered in Fall of even years.
- 348. **Sanitary Bacteriology.** I. 3 hr. PR: Bact. 141. Standard bacteriological methods used in routine examination of water and sewage. Offered in Fall of odd years.
- 414. **Soil Microbiology.** II. 4 hr. PR: Bact. 141 and organic chemistry. Occurrence and distribution of microorganisms in soils and their interrelationships. Their role in decomposition of organic matter and other transformations of soil constituents. Offered in Spring of odd years.
- 420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.)
- 450. **Seminar.** I, II. 1 hr. per sem.
- 497. **Research.** I, II, S. 1-15 hr.

### **Plant Pathology**

#### **Plant Path.**

- 201. **General Plant Pathology.** I. 4 hr. PR: Bact. 141. Nature and causes of plant diseases; methods of control.
- 301. **Diseases of Economic Plants.** I, II, S. 1-3 hr. per sem., 2 hr. in summer. PR: Plant Path. 201 and 303 or consent. Recognition, cause, and control of diseases of economic plants; Sem. I, Diseases of vegetable crops and of tree and small fruits; Sem. II, Diseases of ornamental plants and field and forage crops. S, Diseases of forest trees. Students may register for 1-3 hr. in Sem. I and II, 2 hr. in Summer, until 8 hours of credit are accumulated. Offered in 1969-70 and in alternate years.
- 302. **Principles of Plant Pathology.** II. 4 hr. PR: Bact. 141 and either Plant Path. 152, 201, or 303, or consent. Primarily for graduate students and seniors majoring in botany, biology, or agricultural science. Nature of disease in plants with practice in laboratory methods. Offered in Spring of even years.
- 303. **Mycology.** I. 4 hr. Lectures, field and laboratory studies of parasitic and saprophytic fungi.
- 309. **Nematology.** II. 3 hr. PR: Plant Path. 201 or consent. Primarily for graduate students majoring in the agricultural sciences, zoology, or botany. Nematode taxonomy, bionomics, and control, with particular emphasis on plant parasitic forms. Offered in Spring of odd years.
- 402. **Physiology of Plant Diseases.** I. 2 hr. PR: Agr. Biochem. 291 and Plant Path. 202, or consent. A study of host-parasite interactions, with emphasis on the physiological and biochemical changes that occur in higher plant tissues in response to pathogenic organisms. Offered in Fall of even years.



- 420. **Special Topics. I, II.** S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
- 430. **Physiology of the Fungi. II.** 4 hr. PR: Organic chem., mycology, and bact., or consent. Physiological aspects of growth, reproduction, and parasitism of fungi, with emphasis on nutrition, environment, and other biotic factors.
- 440. **Taxonomy of the Fungi.** S. 3 hr. PR: Plant Path. 203. Collection and identification of fungi with emphasis upon those of economic importance. Offered in Summer of odd years.
- 450. **Seminar. I, II.** 1 hr. per sem.
- 497. **Research. I, II.** S. 1-15 hr.

## **DIVISION OF RESOURCE MANAGEMENT**

The Division is composed of four committees: Agricultural Economics, Agricultural Education, Agricultural Engineering, and Landscape Architecture. The graduate program for Agricultural Engineering is listed under the College of Engineering, and currently there are no graduate degree programs in Agricultural Mechanics or Landscape Architecture. Graduate courses in Agricultural Mechanics and Landscape Architecture are offered to service the needs of students who are seeking their Master of Science degrees in other fields or those who are candidates for the Master of Agriculture degree.

### **Agricultural Economics**

The faculty in Agricultural Economics offers major work for the degree of Master of Science in Agricultural Economics. Economics and Agricultural Economics faculties cooperate in offering a Ph.D. degree in Economics. For details on this degree, see the College of Commerce section.

#### **The Degree of Master of Science**

Students are urged to seek approval from the Admissions Committee of one of the options listed below at the time they begin work. In all cases, approval must be obtained before completion of 18 hours of course work. Students expecting to become professional agricultural economists or who hold research assistantships should seek approval of Option A. Those intending to pursue careers in agricultural business may seek approval of Option B.

#### **Requirements for Admission**

Students may be accepted for graduate study in Agricultural Economics on a regular or probationary basis. Students meeting all of the following requirements are admitted as regular students:

1. A bachelor's degree.
2. Twelve or more semester credits in economics, agricultural economics, statistics, or appropriate social science courses.
3. A grade-point average of 2.5 for all credit in economics and agricultural economics.

Students not meeting the above minimum requirements may petition for admission on a probationary basis. The Admissions Committee will set require-

ments for removing probationary status in each case. Failure of a student to fulfill the terms of his probation shall result in automatic suspension.

Students requesting transfer of graduate credit from courses outside Agricultural Economics must obtain approval of the Admissions Committee for such transfer and the average for such courses transferred must be no less than 2.5. Such petitions must include all courses appropriate to the degree; courses with low grades will not be omitted.

### Options of Study

A. *Thesis Option*—A minimum of 30 credit hours of approved work to include not more than 6 hours of credit for the thesis, and enough courses to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

B. *Course-Work Option*—A minimum of 36 credit hours of approved course work to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

### Standards of Achievement

A minimum grade-point average of 3.0 is required for all graduate credit courses taken as part of the approved program for this degree. This includes graduate credit transferred from within the University and graduate credit accumulated while pursuing a degree in Agricultural Economics.

Students who have earned a grade-point average of 2.75 or more with 12 or more hours of graduate credit will be admitted to candidacy. Those who do not attain this level will be placed on probation.

### Examinations

*Thesis Option.* Satisfactory completion of an oral examination and, at the discretion of the student's graduate committee, a written examination.

*Course-Work Option.* Satisfactory completion of a written and an oral examination.

### Agricultural Economics\*

#### Agr. Econ.

- 206. **Farm Planning.** I. 3 hr. PR: Senior standing. Principal factors influencing returns on farms; planning use of labor, soil, crops, livestock, buildings and equipment. Farm visits required.
- 213. **Economic Development.** I or II. 3 hr. A comprehensive study of the problems, changes, and principal policy issues faced by non-industrialized countries in the process of economic development. This is a dual listing with Economics 213. Students who elect Agr. Econ. 213 may not receive additional credit for Economics 213.
- 231. **Marketing Agricultural Products.** II. 3 hr. Market organization, market policies and practices and factors affecting the marketing of agricultural products. Tour of market agencies and facilities in Pittsburgh area required.

\*Economics 52 or equivalent is required as a prerequisite for all graduate courses offered in Agricultural Economics.

235. **Marketing Dairy Products.** II. 2 hr. Milk marketing policies and practices, including milk-market orders. Offered in Spring of odd years.
240. **Agricultural Prices.** II. 3 hr. An analysis of the price-making forces which operate in the market places for the major agricultural commodities. Tour of market agencies and facilities in Pittsburgh area required.
261. **Agribusiness Finance.** I. 3 hr. Credit needs for agricultural businesses, financing farm and market-agency firms, and organization and operation of credit agencies which finance agricultural business firms. Offered in Fall of odd years.
271. **Agricultural Policy.** II. 3 hr. An examination of the economic aspects of governmental price programs, production and marketing controls, subsidies, parity, export and import policies, and other programs affecting agriculture. Offered in Spring of even years.
300. **Land Economics.** II. 3 hr. Classification, development, tenure, use, conservation, valuation, and taxation of rural, urban, mineral, forest, water, and recreational land resources. Private and public rights in land and the affect of population on the demand for land. Offered in Spring of odd years.
330. **Cooperative Organization.** II. 3 hr. Organization, functions, and contributions of cooperatives in an economic system. Offered in Spring of even years.
342. **Advanced Agricultural Economics.** II. 3 hr.
355. **Resource Analysis.** I. 3 hr. PR: Senior standing. Construction of models consistent with economic reality for allocating the factors of production available on farms, in forests, and in non-farm agricultural businesses to produce profit maximizing plans through the use of linear and dynamic programming and electronic equipment.
420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.)
440. **Advanced Farm Management.** I. 3 hr. Offered in Fall of odd years.
441. **Production Economics.** II. 3 hr. PR: Consent. Economic principles of production with special application to agriculture. Offered in Spring of odd years.
497. **Research.** I, II, S. 1-15 hr.

## **Agricultural Education**

Candidates for the Master of Science degree with a major in Agricultural Education must have done satisfactory work as undergraduates. The student's candidacy must be approved by the Admissions Committee. Candidates for the master's degree in agricultural education must have fulfilled the requirements for B.S. Agr. at West Virginia University or at an approved institution offering an equivalent degree. Also, the candidate must have completed a minimum of 20 hours in education and 45 hours in agriculture.

Students shall combine graduate courses in agriculture and in education by taking 16 to 20 hours in agriculture and 10 to 14 hours in education. A minimum of 5 hours shall be in professional courses dealing with agricultural education. All graduate courses offered toward a degree must have prior approval of the adviser. The student and the adviser shall arrange a specific curriculum to be pursued for the degree at the beginning of the graduate program. A thesis or problem is required as a part of the 30 hours of graduation.

Students shall complete in residence 15 hours of course work after having completed one or more years of teaching vocational agriculture. This shall



apply unless the student has been granted permission by the faculty in Agricultural Education to complete his graduate work without teaching experience.

## Education

### Ed.

- 363. **Teaching Young and Adult Farmer Classes.** I, S. 2 hr. PR: Ed. Psych. 106. Participation in conducting young and adult farmer classes and school-community food preservation centers; organization, course of study, and methods of teaching and supervision, and young farmers' association.
- 364. **Organizing and Directing Supervised Farming Programs.** II, S. 2 hr. PR: Consent. Planning programs of supervised farming, supervising and evaluating such programs for all-day students, young farmers, and adult farmers.
- 460. **Planning Programs and Courses for Vocational Agriculture Departments.** I, S. 2 hr. PR: C & I 188. Gathering data, studying the farming problems of all-day students, young farmers, and adult farmers, and planning the total program for the department.

## Agricultural Education

### Agr. Ed.

- 320. **Special Topics.** I, II, S. 1-4 hr. (For the Master's Degree, Special Topics ordinarily may count for 2 to 4 hr.; max. credit, 6 hr.).
- 360. **Principles of Cooperative Extension.** I. 2 hr. PR: Consent. Background, philosophy, and history of cooperative extension. Activities of county cooperative extension agents and cooperative extension programs in West Virginia.
- 361. **Method and Materials in Extension Education.** II. 2 hr. PR: Consent. Organization and preparation for extension teaching and the processes of communication.
- 362. **Program Building in Cooperative Extension.** II. 3 hr. PR: Consent. Organization in relation to program building. Leadership and group action. Over-all working and educational objectives, principles, methods, and goals in developing county extension programs.
- 461. **Seminar.** S. 1 hr.
- 462. **Problem.** I, II, S. 1-3 hr. (For the Master's Degree).
- 497. **Research.** I, II, S. 1-15 hr.

## Agricultural Mechanics

### Agr. Mech.

- 253. **Advanced Farm Machinery.** II. 3 hr. Performance of agricultural equipment including calibration, efficiency, adjustments, and maintenance. Theoretical and practical aspects of selection based on economics, compatability of machines with other equipment and the farming operation, service, and factors of custom operation. 2 hr. rec., 3 hr. lab.
- 259. **Farm Structures.** II. 3 hr. Fundamentals of construction, functional requirements, materials, new equipment, and use of laborsaving ideas and machinery. 2 hr. rec., 3 hr. lab.
- 270. **Electricity in Agriculture.** II. 3 hr. The study of the fundamentals of electrical energy and its application to lighting, power, heating, and control circuits used in agriculture. 2 hr. rec., 3 hr. lab.
- 275. **Agricultural Engines.** I. 3 hr. Relation of theory to design and operation of internal combustion engines with emphasis on care, operation, and mainten-

- ance. Study covers one, two, three, four, six, and eight cylinder engines, both in two and four stroke designs. 2 hr. rec., 3 hr. lab.
352. **Advanced Farm Mechanics. II.** 3 hr. PR: Agr. Mech. 152. Forging, cold-iron work, tool fitting, woodworking. Offers training for teaching shop work in rural high schools. 1 hr. rec., 6 hr. lab.
420. **Special Topics. I, II, S.** 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
497. **Research. I, II, S.** 1-15 hr.

## **Landscape Architecture**

### **L.A.**

248. **Design Analysis. II.** 2 hr. PR: Consent. Analysis of planning and design projects with respect to offering solutions to a given problem. Offered in Spring of even numbered years.
250. **Landscape Architectural Design. I.** 5-7 hr. PR: L.A. 151 and/or Consent. Advanced design, a continuation of Landscape Architecture 150 and 151 with more comprehensive problems and in-depth collaborative study.
251. **Landscape Architectural Design. II.** 7 hr. PR: L.A. 250 or Consent. Advanced comprehensive design problems, continuing Landscape Architecture 250 theme, but generally requiring individual work.
265. **Regional Design. I.** 3 hr. PR: Consent. Consideration of regional landscapes in order to effectively relate design to the ecology and development of a region. Offered in Fall of odd years.
276. **Recreation Planning. I.** 3 hr. PR: Consent. Design of park and recreation areas involving park history, classification theory, and administration.
284. **Professional Practice. II.** 2 hr. PR: Consent. The profession of landscape architecture involving the procedures in the preparation of contract documents, fees, estimates, operation of an office, and the relationship to clients and contractors. Offered in Spring of even years.

# College of Arts and Sciences

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## BIOLOGY

The Department of Biology offers work leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy in Biology. The department has certain requirements in addition to those of the Graduate School. Current information concerning the graduate programs of the department should be acquired by writing the Chairman, Department of Biology, before seeking admission to the Graduate School. Students may enroll in graduate courses and may work toward an advanced degree only with the approval of the department.

Applicants are expected to have a broad foundation of training in biology and related sciences, particularly chemistry, mathematics, and physics. The applicant is also expected to present Graduate Record Examination scores and three letters of recommendation for evaluation. Deficiencies in undergraduate training may prolong the required program for advanced degrees.

A summer field station, The Terra Alta Biological Station located at Terra Alta, Preston County, offers two summer sessions for course work and research. Write to TABS, Department of Biology, for descriptive folder.

Course offerings are subject to change.

### Laboratory Fees

A nonrefundable fee is required of students taking the following laboratory courses in Biology.

Course	Per Sem.	Course	Per Sem.
Biol. 215	\$ 8.00	Zool. 233	\$ 8.00
Biol. 274	12.00	Zool. 236	12.00
Bot. 221	8.00	Zool. 237	4.00
Bot. 231	8.00	Zool. 251	8.00
Bot. 232	8.00	Zool. 255	8.00
Bot. 235	8.00	Zool. 263	8.00
Bot. 250	8.00	Zool. 264	8.00
Bot. 256	8.00	Zool. 265	4.00
Bot. 261	8.00	Zool. 271	8.00
Bot. 262	8.00	Zool. 272	12.00
Zool. 224	8.00	Zool. 276	12.00
Zool. 231	12.00	Zool. 296	4.00
Zool. 232	12.00	Zool. 297	4.00

### Biology

#### Biol.

205. **Principles of Evolution.** I, S. 3 hr. PR: Biol. 2 or equiv. Introduction to the study of evolution.
207. **History of Biology.** I. 3 hr. PR: Biol. 2 or equiv. History of the development of biological knowledge, with philosophical and social backgrounds.
208. **Great Texts of Biology.** II. 1 hr. PR: Biol. 2 or equiv. A study of some of the great classics in biology, such as Theophrastus' *Enquiry into Plants*, Vesalius' *Epitome*, Harvey's *Motion of the Heart and Blood*, Darwin's *Origin of Species*, and Mendel's *Experiments on Hybrid Plants*.



215. **Cytology.** II. 4 hr. PR: Biol. 2 or equiv. Cells, their structure and function.
274. **Cellular and Molecular Biology.** II. 4 hr. PR: Biol. 2 or equiv., Chem. 238, and Physics 2. A study of fundamental cellular activities and their underlying molecular processes.
- 296, 297. **Special Topics.** I, II. 1-4 hr. per sem. PR: Consent. Critical studies of topics to be determined in consultation with the instructor.
321. **Seminar in Ecology.** I. 1 hr. per sem. PR: Bot. 221, Zool. 224 or W.M. 312 and consent. Selected topics on relations of organisms to environment and on communities of organisms.
- 376, 377. **Seminar.** I, II. 2 hr. per sem. PR: Biol. 274, Bot. 273, Zool. 271, or Pl. Path. 330, and consent. Selected topics on functions common to all organisms.
460. **Seminar in Systematic and Evolutionary Biology.** I, II. 1 hr. per sem. PR: Consent. Seminar concerned with recent developments in systematic and evolutionary biology.
476. **Seminar in Cellular and Molecular Biology.** I. 1-2 hr. per sem. PR: Consent. Critical discussion of current trends and concepts in cellular and molecular biology.
477. **Seminar in Cellular and Molecular Biology.** II. 1-2 hr. per sem. PR: Consent. Critical discussion of current trends and concepts in cellular and molecular biology.

## Botany

### Bot.

- 201, 202. **Seminar.** I, II. 1 hr. Topics of general interest to botanists are considered.
221. **Plant Ecology.** I. 4 hr. PR: Biol. 2 or equiv. Environmental relationships of plants.
224. **Plant Communities.** S. 3 hr. PR: Biol. 2 or equiv. Field studies in the plant ecology of the central Appalachians.
227. **Geographic Botany.** I, S. 3 hr. PR: Biol. 2 or equiv. Study of plant groupings and worldwide distribution of plants.
231. **Plant Morphology.** I. 4 hr. PR: Biol. 2 or equiv. Development and structure of algae and fungi.
232. **Plant Morphology.** II. 4 hr. PR: Biol. 2 or equiv. Development and structure of bryophytes and vascular plants.
235. **Plant Anatomy.** I. 4 hr. PR: Biol. 2 or equiv. Anatomy of seed plants.
236. **Plant Morphogenesis.** II. 4 hr. PR: Organic Chem. or Biochem.; Pl. Anat. or Cytology, Pl. Phys. or Genetics. Experimental studies of plant growth and developments.
250. **Fresh-Water Algae.** I. 4 hr. PR: Biol. 2 or equiv. Taxonomy, cytology, and ecology of aquatic, aerial and land forms of fresh-water algae.
255. **Bryophytes.** II. 2 hr. PR: Biol. 2 or equiv. Identification of liverworts and mosses.
256. **Vascular Cryptogams.** II. 4 hr. PR: Biol. 2 or equiv. Taxonomy, anatomy, cytology, and ecology of the club-mosses, horsetails, and ferns.
261. **Advanced Systematic Botany.** I. 3 hr. PR: Bot. 161 or equiv. Taxonomy of peridophytes, gymnosperms, and monocotyledons.
262. **Advanced Systematic Botany.** II. 3 hr. PR: Bot. 161 or equiv. Taxonomy of dicotyledons.
263. **Taxonomy of Vascular Plants.** S. 3 hr. PR: Biol. 2 or equiv. Field studies in the taxonomy of higher plants.

265. **Aquatic Seed Plants.** I. 3 hr. PR: Biol. 2 or equiv. Classification, ecology, and economic importance of aquatic seed plants.
266. **Flora of West Virginia.** II, S. 3 hr. PR: Biol. 2 or equiv. A consideration of the native plant life of the State.
268. **Dendrology.** II, S. 2 hr. PR: Biol. 2 or equiv. Identification and classification of woody plants.
- 296, 297. **Special Topics.** I, II, S. 1-4 hr. per sem. PR: Consent. Critical studies of topics to be determined in consultation with the instructor.
316. **Cytotaxonomy.** II. 3 hr. PR: Biol. 2, Bot. 161, Genet. 221, or consent. The determination of phylogenetic relationships by cytological and taxonomic methods.
325. **Experimental Plant Ecology.** II. 2-4 hr. PR: Bot. 161, and Bot. 221 or equiv. Advanced field studies in plant ecology.
331. **Plant Embryology.** II. 2 hr. PR: Biol. 2 or equiv. and consent. Gametogenesis, syngamy, and embryo development in vascular plants.
- 351, 352. **Problems in Plant Taxonomy.** I, II. 1-6 hr. PR: Bot. 261, 262, or equiv.
374. **Advanced Plant Physiology.** I, II. 3 hr. PR: Bot. 171 or equiv., organic chemistry, general physics, and consent. Advanced studies of plant processes including recent advances in the field. I. Fall semester, even numbered years—Respiration, photosynthesis, and related processes. II. Spring semester, odd-numbered years—Water relations and mineral nutrition and translocation. III. Fall semester, odd-numbered years—Plant growth and development. IV. Spring semester, even-numbered years—Environmental physiology.
497. **Research.** I, II, S. 1-15 hr.

## Zoology

### Zool.

210. **Animal Behavior.** I. 3 hr. PR: Biol. 2 or equiv. Principles of individual and group behavior.
222. **Field Studies of Invertebrates.** S. 3 hr. PR: Biol. 2 or equiv. Taxonomy and ecology of the invertebrates.
223. **Field Studies of Vertebrates.** S. 3 hr. PR: Biol. 2 or equiv. Taxonomy and ecology of the vertebrates.
224. **Limnology.** I. 4 hr. PR: Biol. 121 or consent. Physical, chemical, and biological characteristics of inland waters with an introduction to the principles of biological productivity.
231. **Comparative Anatomy.** I. 5 hr. PR: Biol. 2 or equiv. Organisms and systems of various vertebrates, together with other facts of interest concerning these animals.
232. **Vertebrate Embryology.** II. 5 hr. PR: Biol. 2 or equiv. Introductory study of development of vertebrates, based on frogs, fowls, and mammals.
233. **Comparative Histology.** II. 4 hr. PR: Zool. 231 and consent. Limited to seniors and graduate students. A comparative study of tissues of the vertebrates.
235. **Comparative Developmental Anatomy.** II. 3 hr. PR: Zool. 231. Anatomy and development of the organs and systems of various vertebrates.
236. **Comparative Neuroanatomy.** II. 4 hr. PR: Biol. 104 or Zool. 231, and consent. Comparative study of development and anatomy of the nervous systems of the vertebrates.
237. **Osteology.** I. 2 hr. PR: Biol. 2 or equiv. Development and anatomy of the skeleton.

251. **Invertebrate Zoology. I.** 4 hr. PR: Biol. 2 or equiv. Advanced study of animals without backbones.
255. **General Parasitology. I.** 4 hr. PR: Biol. 2 or equiv. The biology of parasites.
263. **Ichthyology. II.** 3 hr. PR: Biol. 104 or consent. Systematics and evolution of fishes with a comparative treatment of genetics development, anatomy, and physiology.
264. **Fisheries Biology. II.** 4 hr. PR: Zool. 263 or consent. Population dynamics in relation to principles and techniques of fish management.
265. **Ornithology. II.** 3 hr. PR: Biol. 2 or equiv.; consent. Field and laboratory studies on identification, migration, protection, nesting, and food habits of birds.
271. **Human Physiology. I, II, S.** 4 hr. An introductory course in the functions of man.
272. **Physiology of the Endocrines. I.** 4 hr. PR: Organic chemistry and vertebrate embryology or consent. Regulation of the organs of internal secretion, mechanisms of action of the hormones, and experimental techniques used in study of the endocrine system.
275. **Vertebrate Physiology. I.** 4 hr. PR: Biol. 2 or equiv. The functions of vertebrate organs and organ systems.
276. **Comparative Physiology. II.** 4 hr. PR: Biol. 1 and 2 and organic chemistry or consent. A study of the diverse ways in which different kinds of animals meet their functional requirements.
- 296, 297. **Special Topics. I, II, S.** 1-4 hr. per sem. PR: Consent. Critical studies of topics to be determined in consultation with the instructor.
331. **Special Topics in Comparative Vertebrate Anatomy. I, II.** 1-4 hr. PR: Consent. Critical studies of topics to be determined in consultation with the instructor.
332. **Special Topics in Vertebrate Embryology. I, II.** 1-4 hr. PR: Consent. Critical studies of topics to be determined in consultation with the instructor.
351. **Advanced Invertebrate Zoology. I, II.** 1-4 hr. PR: Zool. 251 and consent.
368. **Mammalogy. I.** 3 hr. PR: Biol. 2 or equiv., and 8 hr. upper division. The study of mammals and their biological properties with emphasis on the life history, ecology, and distribution of regional forms. Offered only in even-numbered years.
497. **Research. I, II.** 1-15 hr.

## CHEMISTRY<sup>1</sup>

The Department of Chemistry offers graduate studies leading to the degree of Master of Science and Doctor of Philosophy with research concentration in the areas of analytical, inorganic, organic, physical, and theoretical chemistry. Both of these degrees require completion of a research project which represents the principal theme about which the graduate program is constructed.

Applicants for graduate studies in chemistry must have as a minimum requirement a bachelor's degree with a major or concentration in chemistry and an appropriate background in physics and mathematics. All entering graduate

<sup>1</sup>For information concerning courses in chemistry available in the West Virginia University Kanawha Valley Graduate Center, write to: Dean, West Virginia University Kanawha Valley Graduate Center, P. O. Box 547W, Nitro, W. Va. 25143.



students in chemistry are required to take Departmental Guidance Examinations in the major areas of chemistry. These examinations, on the undergraduate level, are administered prior to registration and serve to guide the faculty in recommending a course program for the beginning graduate student. Deficiencies revealed on the Guidance Examinations need to be corrected in a manner prescribed by the faculty.

The general Graduate School requirements for the Master of Science degree have been outlined elsewhere in this bulletin. Graduate students in the M.S. program in the Department of Chemistry are required to submit a research thesis and thus may enroll in a maximum of 6 hours of research. The remaining 24 hours of credit must be earned in basic graduate courses which reflect a diversified exposure to chemistry; no more than 10 hours may be elected outside the Department of Chemistry. A final oral examination of the M.S. candidate is administered after completion and submission of the thesis.

The program for the degree of Doctor of Philosophy reflects a flexible, research-oriented approach geared to develop the interests, capability and potential of mature students. A program of courses is recommended to suit individual needs based on background, ability, and maturity. These courses are classified as basic graduate courses which present the essentials of a given discipline on an advanced level, and specialized graduate courses which take one to the frontiers in a specific area of research. The course offerings are designed to provide guidelines from which graduate students can launch their independent studies in preparation for Candidacy Examinations. Students are required to enroll in the departmental seminar program and are expected to attend special lectures and seminars offered by visiting chemists.

All graduate students in the Ph.D. program are expected to achieve a certain diversified background in the major areas of chemistry. This may be ascertained in some cases by the Guidance Examinations combined with academic record while in other instances courses are necessary (such as two semesters of physical chemistry and one semester of organic chemistry). The Departmental Graduate Studies and Guidance Committee aids in establishing when students begin the Candidacy Examinations which consist of both a written and oral portion. The written examinations are of the cumulative type and are offered ten times a year. The oral examination is based on a proposition for a research problem not intimately related to the student's own problem, or any particular research problem being actively pursued at West Virginia University. This proposition is presented in writing to the student's research committee and defended before that group and any other interested faculty members.

Completion of the language requirement, which must be taken in German unless prior approval for another language is obtained from the Department and the Dean of the Graduate School, and satisfactory completion of the candidacy examinations is required before a student is admitted to candidacy for the Ph.D. degree.

Research which is the major theme of graduate studies may be initiated as early as the student and faculty feel appropriate for each individual case. Normally a student will begin laboratory work during his first summer or in September of the following year. Upon successful completion of an original piece of research, the candidate will present his results in a Ph.D. dissertation and at the appropriate time defend his work in a final oral examination.

Details regarding the Graduate School requirements for the M.S. and Ph.D. degrees and information about financial assistance available for graduate students in chemistry can be found in earlier portions of this bulletin. Additional questions on these matters may be directed to the Chairman of the Department of Chemistry.

### Laboratory Fees

A nonrefundable fee is required of all students who register for the following laboratory courses in Chemistry:

Chem. 202	.....	\$16.00	Chem. 220	.....	\$16.00
Chem. 210	.....	16.00	Chem. 235	.....	16.00
Chem. 211	.....	16.00	Chem. 239	.....	16.00

### Chemistry

#### Chem.

202. **Selected Topics. I, II.** 1-3 hr. PR: Consent. Individual instruction under supervision of an instructor.
210. **Instrumental Analysis. II.** 3 hr. PR: Chem. 143 and 235. Basic instrumentation of analytical measurement. Electronics and instrument design. Methods of electrochemical and spectrochemical analysis. Two periods of lecture and one 3-hr. laboratory each week.
211. **Intermediate Analytical Chemistry. I.** 3 hr. PR: Chem. 210. Basic concepts of analytical procedures and separations at an advanced level. Two periods of lecture and one 3-hr. laboratory each week.
220. **Techniques of Chemical Syntheses. II.** 2 hr. PR or conc.: Chem. 221. Modern techniques involved in the preparation and handling of inorganic and organic materials. Inert atmosphere, vacuum system, high temperature and pressure, fractional crystallization, distillation, sublimation, chromatography, separation of isomers, non-aqueous solvents, microscopy and other special techniques. Two 3-hr. laboratories each week.
222. **Chemistry of Inorganic Compounds. II.** 3 hr. PR: Chem. 242. A correlation of the reactions and properties of elements and their compounds based on modern theories of chemical bonding and structure. Topics include acid-base theory, non-aqueous solvents, ligand field theory and stereochemistry. Three periods of lecture each week.
235. **Methods of Structure Determination. I.** 4 hr. PR: Chem. 134 and 136. Both chemical and physical methods are used to study unknowns. Application of physical methods (u.v., i.r., n.m.r., e.s.r., Raman and mass spectroscopy) to problems of organic chemistry with emphasis on structure elucidation. A practical course for students in chemistry and related fields who may need these methods in research and applied science. Two lectures and two 3-hour laboratories per week.
239. **Organic Syntheses. II.** 2 hr. PR: Chem. 136. Modern synthetic methods of organic chemistry. Two 3-hr. laboratories each week.
242. **Chemical Bonding and Molecular Structure. I.** 3 hr. PR: Chem. 144 and 210. An introduction to the quantum theory of chemical bonding. Atomic structure, spectroscopy, predictions of molecular structures and bond properties. Three periods of lecture each week.
244. **Colloid and Surface Chemistry. II.** 2 hr. PR: Physical Chemistry. Selected topics in the properties and physical chemistry of systems involving macromolecules, lyophobic colloids, and surfaces. Two periods of lecture each week.

331. **Advanced Organic Chemistry I.** I. 3 hr. PR: Chem. 134. Structural concepts, localized and delocalized bonding, tautomerism, static and dynamic stereochemistry, mechanistic classifications of reagents and reactions including some applications. Three periods of lecture each week.
332. **Advanced Organic Chemistry II.** II. 3 hr. PR: Chem. 331. A continuation of Chem. 331 with emphasis upon synthetic methods and reaction mechanisms, including carbonium ions, carbanions, and free radical chemistry. Three periods of lecture each week.
335. **Polymer Chemistry.** I or II. 2 hr. PR: Chem. 331. Polymerization processes (methods, reaction types, mechanisms), structural determination and concepts, physical and chemical properties of polymers. Two periods of lecture each week.
341. **Chemical Thermodynamics.** II. 3 hr. PR: Chem. 144. Principles of classical and statistical thermodynamics and their application to chemical problems. Three periods of lecture each week.
- 411, 412. **Seminar in Analytical Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of analytical chemistry.
413. **Electrochemistry and Instrumentation.** II. 3 hr. PR: Chem. 210. Electronic instrumentation as applied to the study of mass transfer, kinetics of electrode reactions, voltammetry, and high-frequency methods. Three periods of lecture each week.
414. **Spectroscopic Methods.** II. 3 hr. PR: Chem. 210. Problems in the design of instruments for each of the various spectral regions. Three periods of lecture each week.
- 417, 418. **Advanced Topics in Analytical Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of analytical chemistry.
- 421, 422. **Seminar in Inorganic Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of inorganic chemistry.
423. **Advanced Inorganic Chemistry.** I. 3 hr. PR: Chem. 222. Advanced topics in modern inorganic chemistry including bonding theories, stereochemistry, non-aqueous solvent systems, physical methods and current topics. Three periods of lecture each week.
424. **Coordination Chemistry.** II. 3 hr. PR: Chem. 222, corequisite Chem. 242. Ligand field theory, spectral interpretations, stability considerations, synthetic methods, unusual oxidation states, organometallic compounds, other topics of current interest. Three periods of lecture each week.
425. **Inorganic Reactions and Mechanisms.** I or II. 2 hr. PR: Chem. 423, 424 and 443. A detailed study of substitution, isomerization, racemization, and oxidation-reduction reaction. Two periods of lecture each week.
426. **Chemistry of Non-Metals.** I or II. 2 hr. PR: Chem. 222. Electrodeficient compounds, sulfur-fluorine chemistry, inorganic polymers, rare gas compounds, solid-state chemistry of silicon and germanium, other topics of current interest. Two periods of lecture each week.
- 427, 428. **Advanced Topics in Inorganic Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of inorganic chemistry.
- 431, 432. **Seminar in Organic Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of organic chemistry.
433. **Physical Organic Chemistry.** I. 3 hr. PR: Chem. 331. Theoretical considerations of organic molecules, kinetics and other methods used in the study of organic structure and reaction mechanisms, linear free energy relationship and other related topics. Three periods of lectures each week.



436. **Heterocyclic Chemistry.** I or II. 3 hr. PR: Chem. 331. A systematic survey of the chemistry of the major heterocyclic systems and discussion of selected natural products containing heterocycles. Three periods of lecture each week.
- 437, 438. **Advanced Topics in Organic Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of organic chemistry.
- 441, 442. **Seminar in Physical Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of physical chemistry.
443. **Chemical Kinetics.** I. 3 hr. PR: Chem. 144. Theories and applications of kinetics in gaseous state and in solution. Three periods of lecture each week.
444. **Statistical Mechanics.** I or II. 3 hr. PR: Chem. 446. Theory and application of statistical mechanics to chemical systems. Three period of lecture each week.
445. **Theoretical Chemistry I.** I. 3 hr. PR: Differential equations. Theoretical background for quantum mechanics. Three period of lecture each week.
446. **Theoretical Chemistry II.** II. 3 hr. PR: Chem. 445. Theories and applications of quantum mechanics in chemistry. Three periods of lecture each week.
447. **Molecular Spectroscopy and Structure.** I. 3 hr. PR: Chem. 446. An advanced course in the application of spectral methods to a study of molecular structure. Three periods of lecture each week.
- 448, 449. **Advanced Topics in Physical Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of physical chemistry.
497. **Research.** I, II. 1-15 hr.

## ECONOMICS

Graduate programs in Economics leading to the Master of Arts and Doctor of Philosophy degrees are listed and discussed under the College of Commerce section of this catalog.

## ENGLISH LANGUAGE AND LITERATURE

**Admission:** To be admitted to the Department of English as a prospective candidate for the degree of Master of Arts, a student is expected to have completed work comparable to the Department's undergraduate requirement for English majors and to present a record distinctly above the average.

If as an undergraduate the applicant majored in English, the general average of grades in all English courses must be no lower than B. If the applicant's average in all English courses is lower than B, the Committee on Admissions may extend a "Probational Admission" for one semester, at the end of which the student's status will be determined by the Committee.

If as an undergraduate the applicant majored in a subject other than English, he will be admitted only on condition that he fulfill, to the extent of his particular deficiency, the normal course and credit obligations of the undergraduate English major at West Virginia University. Such an admission is termed a "Conditional Admission."

**Course Requirements:** A candidate for the M.A. degree will be expected to complete courses covering the major periods and the works of the major authors of English literature. The minimum requirement is 36 hours of graduate work.

**Examinations:** In addition to the final oral examination related particularly to the student's field of special interest as reflected in the Master's thesis, a graduate student in English is required to take two three-hour comprehensive written examinations in English and American literature. The student will normally take these examinations in the semester or term following that in which he has established acceptable credit in 24 hours of graduate course work with an average of 3.0. The examinations will be conducted not later than four weeks before the last day of classes of a semester, or three weeks before the end of a summer term. With the permission of the Examining Committee, an unsuccessful candidate may be re-examined. Success in the examination admits the student to candidacy for a graduate degree.

**Thesis:** For students who have entered or may enter full graduate status in the Department prior to the first semester 1969-70, the writing of a thesis shall remain optional under the terms stated in the *Graduate School Announcements* for 1968-69. A student who enters in the fall of 1969 or later shall be required to write a thesis of a type and on a subject approved by the Department. The student will write under the supervision of a thesis adviser to be assigned. Information about the procedure and the dates for filing application for approval of projects, and about dates for submission of theses, is available at the office of the Department. The thesis may be a work of scholarship, of criticism, or of creative writing (original poetry, drama, or fiction).

The thesis shall count for six hours of graduate credit.

**Foreign Language Requirement:** A candidate for the degree of Master of Arts in English must have completed studies in a foreign language (preferably French or German) equivalent to 12 semester hours of college work. If an applicant does not meet this requirement, he may prepare to meet it through independent study, or otherwise, in order to show a reading knowledge on examination.

## English

218. **Creative Writing. II.** 3 hr. PR: English 115 and 116 or 117 or their equivalent, or by consent. An advanced workshop in creative writing, designed for students who are seriously engaged in the writing of a major work.
222. **Modern American Biography. I.** 3 hr. A selection of the most significant and interesting biographies and autobiographies of Americans of distinction in literature, the arts, and public life.
223. **Modern British Biography. II.** 3 hr. Representative works by such eminent masters of biography as Lytton Strachey, Sir Osbert Sitwell, Lord David Cecil, Sean O'Casey, Hugh Kingsmill, and others.
224. **Literary Criticism. II.** 3 hr. The history of literary criticism from Aristotle to modern times.
225. **Recent Literary Criticism. I, II.** 3 hr. A brief survey of the theories and essays of four major schools of modern criticism and an application of these theories to a novel, a play, and to selected poems and short stories.
228. **Structure of the English Language. I, II.** 3 hr. A course in historical, comparative, and descriptive grammar, together with an introduction to English linguistics.
230. **History of the English Language. I.** 3 hr. A study of the nature of the language; questions of origins, language families, development, relationship of English as one of the Indo-European languages.

231. **Old English (I).** I. 3 hr. A study of Anglo-Saxon with selected readings from the literature of the period.
232. **Old English (II).** II. 3 hr. PR: English 231. **Beowulf** and other texts in Old English.
234. **Chaucer.** I. 3 hr. Early poems, **Troilus and Criseyde**, and **The Canterbury Tales**. In addition to an understanding and appreciation of Chaucer's works, the student is expected to acquire an adequate knowledge of Chaucer's language.
235. **Shakespeare.** I. 3 hr. Intensive study of selected plays. Special attention to textual problems and to language and poetic imagery, together with the history of Shakespearean criticism and scholarship.
236. **Shakespearean Comedies and History Plays.** I. 3 hr. A study of representative comedies of Shakespeare against the background of classical and Renaissance theory and practice, and of selected history plays.
237. **Shakespearean Tragedy.** II. 3 hr. A study of the principal tragedies of Shakespeare, together with the history of criticism, scholarly investigation, and interpretation.
239. **Southern Writers.** II. 3 hr. Examination of twentieth-century Southern essayists, poets, short-story writers, and novelists in relation to the ideological background.
242. **Literature for Teachers.** S. 3 hr. Study and appreciation of selected works of American authors, with special reference to the high-school curriculum. Given usually in the Summer Session.
243. **Literature for Teachers.** S. 3 hr. Study and appreciation of selected works of English authors. Recommended for teachers of high-school English. Given usually in the Summer Session.
244. **Sixteenth Century Prose and Poetry.** I. 3 hr. Studies from Caxton to Bacon, from Skeleton to Shakespeare.
245. **Seventeenth Century Prose and Poetry.** II. 3 hr. Studies from Donne to Dryden.
247. **Literature of the Eighteenth Century.** I. 3 hr. Literature of the period 1700-1750, studied in relation to the social, political, and religious movements of the time.
248. **Literature of the Eighteenth Century.** II. 3 hr. Continuation of English 247, covering the latter half of the century. May be taken independently of English 247.
249. **The Romantic Movement.** I. 3 hr. The works of Wordsworth, Coleridge, and Keats, together with an introduction to works of scholarship in the field of English Romanticism.
250. **American Romanticism.** II. 3 hr. The writing of Ralph Waldo Emerson, Henry David Thoreau, and Nathaniel Hawthorne. A study of the relations of these men to the history of their own time, and of their contributions to American thought and art.
252. **English Literature, 1880-1918.** 3 hr. A study of the more important writers and literary movements of the late Victorian and the Edwardian periods with emphasis on Hardy, Housman, Hopkins, Henley, Pater, Gissing, Moore, Butler, and the writers of the "Aesthetic movement."
253. **Early English Drama.** I. 3 hr. A study of the medieval and early Tudor drama, to the age of Shakespeare.
254. **Elizabethan Drama.** II. 3 hr. A study of the dramas of Shakespeare's contemporaries and successors to the closing of the theatres in 1642. Includes Kyd, Marlowe, Peele, Green, Jonson, Heywood, Marston, Chapman, Webster, Beaumont and Fletcher, Massinger, Ford, and Shirley.



255. **Restoration and Eighteenth Century Drama.** II. 3 hr. Comedy, tragedy, the heroic play, the drama of sensibility and the reaction against it: Etherege, Wycherley, Farquhar, Congreve, Vanbrugh, Dryden, Otway, Goldsmith, and Sheridan.
256. **Modern Drama.** II. 3 hr. A study of world drama from Ibsen to the present day.
257. **Victorian Poetry.** I. 3 hr. A study of the major Victorian poets—Tennyson, Browning, Arnold, Rossetti, Morris, Swinburne, and Fitzgerald, and a few of the later Victorian poets.
258. **Victorian Prose.** II. 3 hr. A study of the non-fictional writings of the great Victorian prose critics: Carlyle, Ruskin, Arnold, Newman, Macaulay, Huxley, and Morris.
261. **American Drama.** I. 3 hr. A study of representative American dramas and of the history of the theatre in America.
262. **Study of Selected Authors.** (American). I, II. 3 hr. A study of the works of a principal American author, or of more than one, as announced when the course is scheduled.
263. **Study of Selected Authors.** (English). I, II. 3 hr. Study of the works of one or more of the principal English authors, as announced in the schedule when the course is listed.
264. **Spenser.** I. 3 hr. A study of Spenser's minor poems and *The Faerie Queene*; forms and sources, purpose of the great epic, social, political, and religious allegory.
265. **Byron and Shelley.** II. 3 hr. Reading and study of the works of two poets of the later Romantic Movement, together with works of criticism and scholarship related to the period.
267. **Milton.** II. 3 hr. A study of all of Milton's poems and a few selected prose works.
270. **American Poetry.** I. 3 hr. A study of the major American poets of the nineteenth and twentieth centuries—Bryant, Poe, Emerson, Longfellow, Whitman, Dickinson, Frost, Eliot. Primary emphasis on their poetry as poetry; background materials minimized.
272. **Folk Literature.** I. 3 hr. A study of the folk ballad, its origin, history, and literary significance, based on Child's collection and on American ballad collections.
273. **Folk Literature of the Southern Appalachian Region.** II. 3 hr. A study of the traditional literature of the people of the Southern Appalachian Region, including songs, prose tales, language, customs, based on material collected in the region, especially in West Virginia.
275. **The English Novel to the Time of Scott.** I. 3 hr. A study of the English novel from the sixteenth century to the time of Scott, showing the development of the novelistic art from early narrative beginnings.
276. **The English Novel, 1832-1900.** II. 3 hr. A continuation of English 275. The development of the English novel from the early nineteenth century to the beginning of the twentieth century.
278. **Tragedy.** II. 3 hr. Masterpieces of tragedy from Greek times to modern, with consideration of the changing concepts of tragedy and of the ethical and ideological values reflected in the works of major tragic authors.
280. **The Modern Novel.** I. 3 hr. The twentieth-century novel, with emphasis upon the work of selected British novelists.

282. **Modern British Poetry.** I, 3 hr. A survey of British poetry from 1890 to the present, including the Decadents, Counter-Decadents, Hopkins, Housman, Hardy, the Georgians, the Imagists, and war poets; Yeats, Eliot, the Auden Group, and the post-World War II poets.
291. **Introduction to Literary Research.** I, II, 3 hr. Bibliography; materials and tools of literary investigations; methods of research in various fields of literary history and interpretation; problem of editing. Practical guidance in the writing of theses.
300. **Thesis.** I, II, 3 hr.
301. **Thesis.** I, II, 3 hr.
- 321, 322. **Medieval Literature.** I, II, 3 hr. each sem. PR: Graduate standing.
- 331, 332. **The Renaissance.** I, II, 3 hr. each sem. PR: Graduate standing. Literary and cultural influences from the Continent on the English literature of the late fifteenth and early sixteenth centuries. Discussion and analysis of major English literary works of the period.
- 341, 342. **English Drama to 1642.** I, II, 3 hr. each sem. PR: Graduate standing. A consideration of the varied aspects of English drama from its medieval beginnings to the middle of the seventeenth century. Discussion and analysis of selected dramas.
- 353, 354. **The Eighteenth Century.** I, II, 3 hr. each sem. PR: Graduate standing.
- 361, 362. **Romanticism.** I, II, 3 hr. each sem. PR: Graduate standing. Studies in major authors and special topics in the field of English Romanticism.
- 371, 372. **The Victorian Era.** I, II, 3 hr. each sem. PR: Graduate standing. Writers of the Victorian period considered in relation to the cultural matrix from which they rise. Particular attention is given to the varying intellectual currents of the era.
- 377, 378. **Folklore and Folk Literature. Seminar.** 3 hr. each sem. PR: Graduate standing. Research projects in folklore, including field work in collecting folklore in the Appalachian region and the analysis of the use of folklore in the works of British and American authors.
- 390, 391. **Seminar.** I, II, 3 hr. PR: Graduate standing. Seminar in principal authors and movements in American literature from the Colonial Period to 1870, with emphasis on topics and authors announced in the schedule.
392. **Seminar.** I, II, 2 or 3 hr. PR: Graduate standing. Specific authors to be approved by the instructor. A graduate study of particular periods of authors.
- 393, 394. **American Literature, 1870- .** I, II, 3 hr. each sem. PR: Graduate standing. Literary and intellectual America from 1870 to 1914 in terms of leading literary men and changing cultural patterns of the period. Discussion and analysis of selected prose and poetic works.
497. **Research.** I, II, 1-15 hr.

## FOREIGN LANGUAGES

The Department of Foreign Languages offers graduate study in French, Spanish, German, Latin, and Greek literature and culture, in linguistics, in language teaching methods, and in bibliography and research. The department also directs a master's program in Latin American Area Studies. Candidates for the master's degree are accepted in French, Spanish, and German, and in Latin American Area Studies.

A student who wishes to do graduate work in this department should apply to the chairman of the department, who will act as his adviser until the

student becomes a candidate for a graduate degree. Usually, he will be expected to have an undergraduate major in a foreign language, preferably the one in which he proposes to major. He should normally show an average of at least 3.0 (B) in his undergraduate foreign language courses.

A candidate must complete at least 36 graduate hours for a master's degree, 24 to 27 hours of which, including Bibliography and Research 265, will be in his major field. Prospective teachers are expected to complete Language Teaching Methods 221, 222 as part of the work in the major field. Six hours of the major work may take the form of a master's thesis. The candidate's committee will make all decisions as to the distribution of courses and the thesis requirement in the light of the student's aims and needs.

## French

- 203. **Refresher Course in Conversational French.** I. 3 hr. PR: Consent. Intensive spoken French designed primarily for teachers of French in the elementary school.
- 205. **Fundamentals for Reading French.** I. 3 hr. Undergraduate credit only. Graduate students must register as auditors. PR: Graduate status or upper-division status. The sequence 205-206 is intended for graduate students from other departments to teach them to read general and technical French.
- 206. **Reading French.** II. 3 hr. Undergraduate credit only. Graduate students must register as auditors. PR: 12 hr. of French or equiv. or French 205. Graduate students may meet the doctoral foreign language requirement by achieving a grade of B or better in this course. Not open to Foreign Language Department majors.
- 217. **French Civilization.** II. 3 hr. PR: 12 hr. of French.
- 221. **The Romantic Movement.** I. 3 hr. PR: A.B. in French or consent.
- 222. **French Realism.** II. 3 hr. PR: A.B. in French, or consent.
- 226. **Literary Criticism.** II. 3 hr. PR: A.B. in French or consent.
- 227. **Graduate Reading in French.** No Credit. A special course to help students prepare for the Ph.D. reading examination in French.
- 229. **Literature of the Sixteenth Century.** I. 3 hr. PR: A.B. in French or consent.
- 231. **Phonetics and Pronunciation.** II. 3 hr. PR: 18 hr. of French or equiv.
- 237. **Moliere.** II. 3 hr. PR: A.B. in French or consent.
- 244. **Explication de Textes.** II. 3 hr. PR: 18 hr. of French or equiv.
- 271. **The Modern Novel to 1930.** I. 3 hr. PR: A.B. in French or consent.
- 272. **The Novel After 1930.** II. 3 hr. PR: A.B. in French or consent.
- 281. **Medieval French Literature.** II. 3 hr. PR: Linguistics 290 (Old French) or consent.
- 292. **Pro-Seminar in French Literature.** 1-6 hr.\* Special topics.
- 392. **Seminar in French Literature.** 1-6 hr.\* Special topics.
- 497. **Research.** 1-15 hr.

## Spanish

- 211. **Nineteenth Century Literature to 1870.** I. 3 hr. PR: Spanish 3 and 4, or equiv.

\*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.



212. **Spanish Literature Since 1870.** II. 3 hr. PR: Spanish 3 and 4, or equiv.
215. **Lyric Poetry.** I. 3 hr. PR: 12 hr. of Spanish, or equiv.
216. **Spanish Civilization and Culture.** I. 3 hr. PR: 12 hr. of Spanish, or equiv.
217. **Spanish-American Literature and Culture.** I. 3 hr. PR: 12 hr. of Spanish, or equiv.
218. **Spanish-American Literature and Culture.** II. 3 hr. PR: 12 hr. of Spanish, or equiv. Continuation of Spanish 217.
221. **Literature of the Golden Age to 1635.** I. 3 hr. PR: 18 hr. of Spanish, or equiv.
222. **The Golden Age After Lope De Vega.** II. 3 hr. PR: 18 hr. of Spanish, or equiv.
223. **Estudios De Estilo.** I. 3 hr. PR: 18 hr. of Spanish, or equiv.
224. **Explicacion De Textos.** II. 3 hr. PR: 18 hr. of Spanish, or equiv.
225. **The Picaresque Novel.** I. 3 hr. PR: 18 hr. of Spanish, or equiv.
227. **Graduate Reading in Spanish.** No credit. A special course to help students prepare for the Ph.D. reading examination in Spanish.
291. **Cervantes.** II. 3 hr. PR: 18 hr. of Spanish or consent.
292. **Pro-Seminar in Spanish Literature.** 1-6 hr.\* Special topics.
295. **Sixteenth Century Literature.** I. 3 hr. PR: 18 hr. of Spanish or consent.
297. **Pro-Seminar in Spanish-American Studies** 1-6 hr.\* Special topics.
392. **Seminar in Spanish Literature.** 1-6 hr.\* Special topics.
395. **Seminar in Spanish-American Studies.** 1-6 hr.\* Special topics.
497. **Research.** 1-15 hr.

## German

201. **Independent Reading.** I. 3 hr. Supervised reading for students who wish to do intensive work in any field of interest.
202. **Independent Reading.** II. 3 hr. Continuation of German 201.
227. **Graduate Reading in German.** No credit. A special course to help students prepare for the Ph.D. reading examination in German.
242. **Faust.** II. 3 hr. PR: German 4 or consent. Critical study of Goethe's Faust.
243. **Medieval German Literature.** I. 3 hr. PR: German 4 or consent.
244. **German Literature of the Reformation and Renaissance.** II. 3 hr. PR: German 4 or consent.
245. **Classicism and Romanticism.** I. 3 hr. PR: German 4 or consent. A critical study of German literature from 1750 to 1830.
246. **The Liberal Age.** II. 3 hr. PR: German 4 or consent. A critical study of German literature from 1830 to 1880, with an emphasis upon poetic realism.
247. **The Age of Crisis.** I. 3 hr. PR: German 4 or consent. A critical study of German literature from 1880 to the present.
265. **German Civilization.** I. 3 hr. PR: 12 hr. of German or consent. A general comprehensive survey of the most important aspects of German culture, including a brief historical background, the development of the German language, geography, science, music, art, architecture, literature, and philosophy.
275. **The Modern Novel.** I. 3 hr. PR: 18 hr. of German. Supervised reading of nineteenth century novels.
276. **The Modern Novel.** II. 3 hr. Continuation of German 275, with emphasis on recent fiction.

- 292. **Pro-Seminar in German Literature.** 1-6 hr.\* Special topics.
- 392. **Seminar in German Literature.** 1-6 hr.\* Special topics.
- 497. **Research.** 1-15 hr.

#### Russian

- 211. **The Russian Novel. I.** 3 hr. PR: Russian 3 and 4 or consent. Study of selected work of Gogol, Goncharov, Turgenev, Leskov, Dostoevsky, and Tolstoy.
- 212. **The Russian Novel. II.** 3 hr. Continuation of Russian 211. Study of Russian prose from Chekhov to the post-war Soviet novelists.

#### Latin

- 201. **Roman Novelists. I.** 3 hr. PR: Latin 109, 110, or equiv. The origin of the novel is traced from Homer to the Medieval Greek and Latin romance writers. Readings include selections from Petronius, the *Cena Trimalchionis*, and from Apuleius, *Cupid and Psyche*.
- 202. **Roman Comedy. II.** 3 hr. PR: Latin 109, 110, or equiv. A brief history of the origin and development of Greek and Roman comedy. Readings include the *Menaechmi* of Plautus, and the *Andria* of Terence.
- 231. **Roman Satire. I.** 3 hr. PR: Latin 109, 110, or equiv. Greek satirical writings and the origin of the Roman satire. Readings include selections from the *Satires* of Horace, and from the *Satires* of Persius and Juvenal.
- 234. **Roman Historians. I.** 3 hr. PR: Latin 109, 110, or equiv. The origin and development of Roman historiography and its Greek antecedents. Readings include selections from Livy's *History*, from Tacitus' *Agricola*, and from Suetonius' *Augustus*.
- 235. **Roman Epic. I.** 3 hr. PR: Latin 109, 110, or equiv. The origin and development of the Greek and Roman epic. Readings include selections from Vergil's *Aeneid*, from Lucretius' *De Rerum Natura*, and from the earlier and later epic poets.
- 236. **Roman Philosophers. II.** 3 hr. PR: Latin 109, 110, or equiv. The origin and development of Greek philosophy and its influence upon Roman philosophy. Readings include selections from Cicero's *Tusculan Disputations* on the immortality of the soul and from Seneca's *Epistles*.
- 237. **Roman Lyric Poetry. I.** 3 hr. PR: Latin 109, 110, or equiv. Origin and development of the Greek and Roman lyric poetry. Readings include selections from Horace, Catullus, Tibullus, and Propertius.
- 292. **Pro-Seminar in Latin Literature.** 1-6 hr.\* Special topics.
- 392. **Seminar in Latin Literature.** 1-6 hr.\* Special topics.

#### Greek

- 292. **Pro-Seminar in Greek Literature.** 1-6 hr.\* Special topics.
- 392. **Seminar in Greek Literature.** 1-6 hr.\* Special topics.

#### Linguistics

- 201. **Linguistics As Applied to Spanish-American Dialects. I.** 3 hr. PR: A.B. in Spanish or consent. To acquaint students with the principles of structural linguistics and those points of structure and vocabulary in which American Spanish differs from standard Castilian.

\*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.

211. **Middle High German. I.** 3 hr. PR: 12 hr. of German from upper division. Study of the linguistic developments of Middle High German from the eleventh to the fifteenth centuries with illustrative reading from the *Nibelungenlied*.
212. **Middle High German. II.** 3 hr. Continuation of Linguistics 211 with illustrative readings from the Middle High German lyric poets and the courtly epics.
225. **Comparative Grammar of Greek and Latin. I.** 3 hr. PR: Consent.
226. **Italic Dialects. II.** 3 hr. PR: Consent.
227. **Vulgar Latin. II.** 3 hr. PR: Latin 109, 110, or equiv. Selections from Latin inscriptions and later Latin literature are studied to illustrate the development of the Latin language from its earliest times to its passing into the Romance languages.
231. **The Structure of Modern Russian. I.** 3 hr. PR: 12 hr. of Russian or consent. Advanced study of Russian morphology and syntax.
232. **The Structure of Modern Russian. II.** 3 hr. PR: Linguistics 231 or consent. Advanced study of Russian morphology and syntax.
251. **History of the German Language. I.** 3 hr. PR: 18 hr. of German or consent. Historical development of standard German with emphasis on its relationship to the other Germanic languages and dialects.
252. **Comparative Germanic Linguistics. II.** 3 hr. PR: Linguistics 251 or consent. A comparative study of Gothic, Old English, Old Norse, Old High German, and Old Saxon.
255. **History of the Spanish Language. I.** 3 hr. PR: A.B. in Spanish or consent. A study of the development of the Spanish language and of the transformation of the Castilian dialect into the national language of Spain.
271. **Old English. I.** 3 hr. PR: Consent. Elementary study of Old West Saxon with illustrative materials from prose and poetry.
272. **Old English. II.** 3 hr. Continuation of Linguistics 271. Comparison of the Old English dialects, with extensive illustrative readings, especially in *Beowulf*.
281. **Old Norse. I.** 3 hr. PR: Consent. Elementary study of Old West Norse prose.
282. **Old Norse. II.** 3 hr. Continuation of Linguistics 281. Readings in various Old Icelandic sagas; introduction to Old Norse poetry.
290. **Old French. II.** 3 hr. PR: Consent.
292. **Pro-Seminar in Linguistics.** 1-6 hr.\* Special topics.
296. **Old Spanish. II.** 3 hr. PR: Consent.
392. **Seminar in Linguistics.** 1-6 hr.\* Special topics.

#### Language Teaching Methods

221. **The Teaching of Foreign Languages. I.** 3 hr. Required of all graduate students who are prospective foreign language teachers.
222. **Language Laboratory Techniques. II.** 3 hr. Required of all candidates for a graduate degree in a foreign language.
270. **Problems in the Teaching of French in the Elementary School. I.** 3 hr. PR: Consent.

#### Bibliography and Research

265. **Methods of Research. I.** 3 hr.

\*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.



## **Latin American Area Studies**

The Master of Arts degree in Latin American Area Studies is an interdisciplinary degree. It is based on 39 credit hours, 12 of which may be obtained in residence at a selected Latin American university.

The courses are intended for graduate students who hold a bachelor's degree, preferably with a major in Spanish, History, Economics, Political Science, Geology, or Sociology and who wish to prepare themselves for some type of work in Latin America.

Each candidate accepted will be assigned to a committee composed of at least one member from the Department of Foreign Languages and other members from the supporting departments.

The objectives of the program are: to make sure the student has a thorough knowledge of Spanish for all purposes, to furnish the student a good background in Latin American culture, and to give the student a sound basis for future teaching, research, or other professional work requiring knowledge of Latin America.

Basic requirements for all candidates are: Spanish 217, 218, 297, 395, Linguistics 201, Geography 219.

Additional courses under this program are grouped as follows:

Group I. History 220, 221, Political Science 246, 255, 267.

Group II. Economics 250, 251, Sociology 260, and six hours of special courses in Anthropology.

Group III. Art 275, Botany 296, Agriculture 320, three hours of special work in Pathology.

The students may complete the requirements for his degree in either of the following ways:

1. At least nine hours from Group I and three hours from Group III, plus additional courses from Groups I, II, or III as desired.

2. At least nine hours from Group II and three hours from Group III, plus additional courses from Group I, II, or III as desired.

## **GEOLOGY AND GEOGRAPHY**

The Department of Geology and Geography offers work leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy in Geology. No graduate degree is offered in Geography.

### **The Degree of Master of Arts**

This degree enables the holder of a baccalaureate degree to become well acquainted, although not professionally trained, in the earth sciences. The program is directed toward teachers, businessmen, and research administrators.

Acceptance by the Graduate School and also by the Department of Geology and Geography is necessary before admission of any prospective student to the program. One departmental requirement is previous college study of scientific subjects. This requirement may be fulfilled by an undergraduate major (or first teaching field) in biology, chemistry, physics, or engineering.

The minimum course work involved is 36 hours (32 of which are at graduate level). This includes 24 hours of specified work, and allows 12 or more

hours in optional and related areas (at least 3 hours of which are in geology). Up to 9 hours of cognate work at the graduate level (in biology, chemistry, physics, engineering, mathematics, or education) may be included in the program. No thesis is required.

### **The Degree of Master of Science**

Before being admitted to candidacy for the Master of Science degree in Geology, the student must have completed the equivalent of the courses listed in the College of Arts and Sciences section of the *Undergraduate Catalog* as curricular requirements for undergraduates majoring in Geology. Students who have not had more than a year of physics, a year of chemistry, and mathematics through Math. 15 (Calculus I), will be required to meet these requirements. They therefore will spend more than the minimum time for the Master of Science or Doctor of Philosophy degrees. Most employment requirements in technical fields, such as petroleum geology, now include not only advanced physics and chemistry but also mathematics through calculus. Employment opportunities are limited unless this requirement is met. Graduate students are expected to take some supporting courses in such allied fields as mining engineering, geophysics, and biology—depending on their major field of geologic studies.

A grade-point average of at least 3.0 (B) is required for an advanced degree in all courses in geology taken in the department while a graduate student. Scores in the general aptitude and geology tests of the Graduate Record Examination must be submitted. Each student must pass satisfactorily a comprehensive qualifying examination as an additional requirement before being admitted to candidacy for an advanced degree.

A thesis is required of all candidates for the Master of Science degree in geology. The thesis may be based on field work done while not in residence at the University by arrangement with the candidate's advisory committee. Final examinations (usually oral) on general geologic knowledge and thesis subject must be passed by each candidate for an advanced degree.

Prospective students are urged to write the Chairman of the Department of Geology and Geography before making application to the Director of Admissions of the University for admission to the Graduate School.

### **The Degree of Doctor of Philosophy**

In addition to the requirements above, the general requirements for the Doctor's degree are set forth in Part II of this bulletin.

### **Opportunities for Research**

Close cooperation between the West Virginia Geological and Economic Survey, located in Morgantown, and the Department of Geology makes a large amount of material available for laboratory investigation. This includes the fossil collections of the Department and the Survey. A large number of samples of drill cuttings from deep wells in West Virginia and adjoining states are housed in the Survey. Morgantown is conveniently situated for detailed studies of Mississippian, Pennsylvanian, and Permian formations. Mineral products of

the region near Morgantown include coal, petroleum, natural gas, and limestone. The occurrence and utilization of these materials can be studied by graduate students interested in economic geology. A permanent summer field camp (Camp Wood) is located in the Folded Appalachians at Alvon, Greenbrier County, West Virginia.

## Geology

### Geol.

201. **Physical Geology for Teachers.** I, II, S. 3 hr. PR: High School teaching certificate, and consent. Composition and structure of earth and the geologic processes which shape its surface.
202. **Physical Geology Laboratory for Teachers.** I, II, S. 1 hr. Accompanies Geol. 201. Laboratory and field study of earth materials and features, and the topographic and geologic maps used to represent them.
218. **Geology and the Earth Sciences.** 4 hr. PR: Open only to members of N.S.F. Summer Institute. The physical nature of the earth. Rotation, revolution, shape, and structure of the earth. Geologic forces changing the earth. Geologic history.
221. **Geomorphology.** I. 3 hr. Surface features of eastern United States.
222. **Geomorphology.** II. 3 hr. Surface features of western United States. (Offered in alternate years).
228. **Photogeology.** II. 3 hr. PR: Geol. 127, 151. Instruction in basic and advanced techniques of air photo interpretation.
231. **Invertebrate Paleontology.** II. 4 hr. PR: Geol. 3, 4. Invertebrate fossils; biological classification, evolutionary development, and use in correlation of strata.
235. **Introductory Paleobotany.** I, II. 4 hr. PR: Geol. 3 and/or Bot. 2. Résumé of development of principal plant groups through the ages, present distribution, mode of occurrence and index species, methods of collection.
261. **Stratigraphy and Sedimentation.** II. 3 hr. Study of sediments and sedimentary rocks. Field techniques stressed as data gathered and interpreted from rocks of Pennsylvanian age in Morgantown vicinity. Two-day field trip required.
266. **Appalachian Geology Field Camp.** S. 6 hr. PR: Geol. 231, 261. Practical experience in detailed geological field procedures and mapping. Living expenses in addition to tuition must be paid at time of registration.
270. **Mineral Resources.** I, S. 3 hr. PR: Geol. 1, 2. General survey of character, origin, and distribution of natural mineral resources, including mineral fuels, nonmetallic minerals, ore deposits, and ground-water.
272. **Petroleum Geology.** II. 1-4 hr. PR: Geol. 151. Origin, geologic distribution, methods of exploration and exploitation, uses and future reserves of petroleum and natural gas in the world.
290. **Geologic Problems.** I, II. 1-6 hr. (Max. 12 hr.). Special problems for seniors and graduates.
291. **Seminar.** I. 1 hr.
329. **Problems in Geomorphology.** I, II. 1-4 hr.
334. **Problems in Paleontology.** I, II. 1-4 hr.
336. **Advanced Paleobotany.** I, II. 4 hr. Continuation of Geol. 235.
339. **Problems in Paleobotany.** I, II. 1-4 hr.
340. **Advanced Stratigraphy.** II. 4 hr. PR: Geol. 231. Study of principles of rock and time correlation, emphasis on their application to the stratigraphy of West Virginia.



344. **Clay Geology.** I, II. 2-3 hr. PR: Geol. 185, 261, 369. Study of clay mineralogy with secondary emphasis on the origin and deposition of clay minerals in the stratigraphic record.
346. **Advanced Sedimentation.** I. 4 hr. PR: Geol. 185. Origin of sedimentary rocks; principles involved in interpretation of ancient geography, climates, animals, and plants.
348. **Problems in Sedimentation.** I, II. 1-4 hr.
349. **Problems in Stratigraphy.** I, II. 1-4 hr.
351. **Tectonic Elements.** II. 3 hr. PR: Geol. 151. Detailed analyses of tectonic elements of North America and Europe.
359. **Problems in Structural Geology.** I, II. 1-4 hr.
362. **Sedimentology Field Camp.** S. 3-6 hr. PR: Geol. 261 or equiv. Field-lab course in experimental, modern, and ancient sedimentation. Living expenses in addition to tuition must be paid at time of registration.
363. **Ground-water Hydrology.** II. 3 hr. PR: Geol. 1 or consent. Study of the principles of ground-water hydrology; occurrence, development, uses, and conservation of ground-water.
369. **X-Ray Diffraction.** I, II. 3 hr. Open to advanced students in geology, chemistry, engineering, and related fields, with consent of instructor. The theory of X-ray diffraction and application to the analysis of crystalline materials using the powder camera and X-ray diffractometer.
371. **Economic Geology: Ore Deposits.** II. 3 hr. PR: Geol. 185. Mineral composition, geologic features, and distribution of deposits of principal useful metallic minerals.
372. **Economic Geology: Nonmetallics.** I. 3 hr. PR: Geol. 185. Occurrence, formation, and use of nonmetallic mineral substances, including building materials and chemicals.
374. **Problems in Economic Geology and Geochemistry.** I, II. 1-4 hr.
385. **Optical Mineralogy.** I. 4 hr. PR: Geol. 185 and one year of Physics. Principles and practice in use of the petrographic microscope in identification of minerals. Emphasis on determination by immersion method.
386. **Petrology.** II. 4 hr. PR: Geol. 285. Composition, texture, occurrence, and origin of rocks. Study of hand specimens and thin sections.
388. **Problems in Mineralogy and Petrology.** I, II. 1-4 hr.
394. **Introductory Geochemistry.** I. 3 hr. PR: Geol. 185 or consent. Evolution of earth as suggested by chemical and physical data, followed by topics of current interest, including geologic thermometry, oxidation potential and pH, and geochemical prospecting.
395. **Geochemistry.** II. 3 hr. PR: Geol. 185 or consent. Mineral systems at low temperatures and low pressures considered in terms of partial pressure, oxidation potential and pH. Laboratory study includes directed investigation of a topic of interest to the student.
432. **Micropaleontology.** I. 4 hr. PR: Geol. 231. Identification of Foraminifera and Ostracoda; emphasis on classification, nomenclature, and use of paleontological literature.
487. **Advanced Petrology.** I. 3 hr. PR: Geol. 386. Study of the composition, classification, and origin of igneous and metamorphic rocks. Laboratory work consists of a study of crystalline rocks by microscopical methods.
497. **Research.** I, II. 1-15 hr.

## Geography

### Geogr.

- 202. **Political Geography.** I. 3 hr. PR: Consent. Examination of spatial inter-relationships of man and his environment in a political setting.
- 203. **Historical Geography of Anglo-America.** II. 3 hr. Exploration, settlement, and changing patterns of human occupancy from the sixteenth century to the present; cultural areas and their significance.
- 210. **Urban Geography.** II. 3 hr. Location, development, and change of urban land use patterns.
- 219. **Problems in Geography.** I, II. 3 hr. per sem.; max. credit 12 hr. PR: Consent.
- 220. **Seminar in Geography.** I, II. 3 hr. per sem.; max. credit 12 hr.
- 240. **Geography of the USSR and Eastern Europe.** II. 3 hr. Regional characteristics and problems of development.
- 246. **Geography of Africa.** II. 3 hr. Systematic and regional characteristics and geographic problems of political, social, and economic development.
- 261. **Cartography.** I. 3 hr. Theory and practice of map design.

## HISTORY

### The Degree of Master of Arts

Candidates for admission to the Master's degree program in history should have had 18 hours of upper-division undergraduate work in history and 9 hours of upper-division undergraduate work in some closely related subject, preferably economics, political science, or sociology. A reading knowledge of one foreign language is desirable. Candidates should have a minimum 2.5 overall average in their undergraduate program and a minimum 3.0 overall average in their majors or minors in history.

The Department of History requires that all candidates for the Master of Arts degree in history present an overall average of 3.0 (B) for all graduate courses taken; it will not accept toward an advanced degree credits in courses offered by the Department of History which are reported with a grade lower than "B."

There are two routes to the Master of Arts Degree in history: a 36-hour degree and a 30-hour degree. The 36-hour degree includes a minimum of 24 semester hours in history, six of which shall consist of courses of the 400 seminar series. It is possible to include in the 36-hour program a minimum of 9 to 12 hours in one minor representing a closely related discipline in the College of Arts and Sciences. It is also possible that all 36 hours be in the Department of History. The candidate for the 36-hour masters will be required to pass a final oral comprehensive examination covering his graduate course work.

The 30-hour degree consists of 24 hours of course work in history and incorporates a thesis for which 6 hours credit may be allowed. The candidate for the 30-hour masters will be required to pass a final oral comprehensive examination covering his graduate course work and his thesis.

### The Degree of Doctor of Philosophy

Requirements for the Ph.D. degree in History include the general requirements of the Graduate School; a reading knowledge of a second foreign lan-

guage approved by the Department; passing the Ph.D. comprehensive examination of two parts (oral and written) administered by a committee of faculty members (normally at the end of a full-time student's second year of study); preparation of an acceptable dissertation based upon original investigation; and successful defense of the dissertation in a final examination.

A candidate must offer a program of study in four fields, at least three of which must be in history; the other may be in a related field approved by the Department. The Department of History requires that all candidates for the Doctor's degree present an overall average of 3.0 (B) for all graduate courses taken; it will not accept toward an advanced degree credits in courses offered by the Department of History which are reported with a grade lower than "B." The fields must be selected from the following:

- |                                    |                                 |
|------------------------------------|---------------------------------|
| 1. History of the U. S. to 1865    | 6. Europe, 1789-present         |
| 2. History of the U. S. Since 1850 | 7. History of England           |
| 3. Medieval History                | 8. History of Asia and Africa   |
| 4. Renaissance and Reformation     | 9. Latin America                |
| 5. Europe, 1500-1815               | 10. Field in another department |

## History

### Hist.

- 201. British Civilization to 1660. 3 hr.
- 202. British Civilization Since 1660. 3 hr.
- 205. Latin American History, Colonial Period and the Wars of Independence. 3 hr.
- 206. Latin America Since 1824. 3 hr.
- 209. The ABC Powers of Latin America. 3 hr.
- 210. Modern Spain. 3 hr.
- 213. The Old Regime in Europe. 3 hr.
- 214. The Revolutionary-Napoleonic Era. 3 hr.
- 217. History of Russia From Ancient Times to Alexander III. 3 hr.
- 218. History of Russia: The Revolutionary Era and the Soviet Period. 3 hr.
- 221. History of Germany From the Roman Era to the Early Nineteenth Century. 3 hr.
- 222. History of Modern Germany. 3 hr.
- 225. History of Modern China. 3 hr.
- 226. History of Modern Japan. 3 hr.
- 229. History of Africa: Pre-Colonial. 3 hr.
- 230. History of Africa: European Dominance to Independence. 3 hr.
- 251. History of the Negro in America. 3 hr.
- 253. Civil War and Reconstruction. 3 hr.
- 255. The Cleveland Era. 3 hr.
- 257. The U. S. From McKinley to the New Deal, 1896 to 1933. 3 hr.
- 259. Recent American History, 1933 to Present. 3 hr.
- 261. Economic and Social Development of West Virginia. 3 hr.
- 301. Social and Economic History of the Middle Ages, 300-1000. 3 hr.



302. Social and Economic History of the Middle Ages, 1000-1500. 3 hr.
305. The Renaissance. 3 hr.
306. The Reformation. 3 hr.
309. English Social History, Fourteenth to Eighteenth Century. 3 hr.
310. English Social History, Eighteenth Century to the Present. 3 hr.
313. European Diplomatic History, 1815 to 1919. 3 hr.
314. European Diplomatic History, 1919 to the Present. 3 hr.
- 317, 318. European Cultural and Intellectual History. 3 hr. each.
351. American Diplomacy to 1918. 3 hr.
352. American Foreign Policy and Diplomacy, 1918 to the Present. 3 hr.
355. Intellectual and Social History of the U. S. to 1876. 3 hr.
356. Intellectual and Social History of U. S. Since 1876. 3 hr.
359. American Economic History to 1865. 3 hr.
360. American Economic History Since 1865. 3 hr.
363. American Labor Movement. 3 hr.
364. History of American Agriculture. 3 hr.
367. The Old South. 3 hr.
368. The New South. 3 hr.
371. American Frontier East of the Mississippi. 3 hr.
372. American Frontier West of the Mississippi. 3 hr.
- 401, 402. Readings, Seminar in Medieval History. 3 hr. each.
- 405, 406. Readings, Seminar in English History. 3 hr. each.
- 409, 410. Readings, Seminar in Central European History. 3 hr. each.
- 413, 414. Readings, Seminar in Eastern European History. 3 hr. each.
- 417, 418. Readings, Seminar in Western European History. 3 hr. each.
- 421, 422. Readings, Seminar in Asian History. 3 hr. each.
- 425, 426. Readings, Seminar in African History. 3 hr. each.
- 451, 452. Readings, Seminar in American History, 1492-1789. 3 hr. each.
- 455, 456. Readings, Seminar in American History, 1763-1865. 3 hr. each.
- 459, 460. Readings, Seminar in American History, 1850-1898. 3 hr. each.
- 463, 464. Readings, Seminar in American History, 1890 to Present. 3 hr. each.
- 467, 468. Readings, Seminar in Frontier History. 3 hr. each.
- 473, 474. Readings, Seminar in Local and Regional History. 3 hr. each.
477. American Historiography. 3 hr.
478. European Historiography. 3 hr.
- 481, 482. Special Problems. 1-3 hr. each.
497. Research. 1-15 hr.

## THE HUMANITIES

The following courses are offered during the Summer only according to demand. They are primarily intended for students of art, humanities, literature, and related fields.

250. **Culture Tour of Europe.** S. 6 hr. PR: Some cultural background in European civilization such as Humanities 1 and 2, Hist. 1 and 2, art survey courses, or equiv., or consent.
260. **Culture Tour of Latin America.** S. 6 hr. PR: Some cultural or historical background in Latin America, such as history or art courses, or consent.
270. **Cradle of History Tour of the Near East.** S. 6 hr. PR: Humanities 1 and 2, Hist. 1 and 2, or equiv., or consent.
280. **Around-the-World Culture Tour.** S. 6 hr. PR: A course in world or western civilization, such as Humanities 1 and 2, Hist. 1 and 2, or consent.

## LIBRARY SCIENCE

*Admission Requirements:* Students wishing to do graduate work in Library Science must satisfy the general requirements for admission to the Graduate School.

The Department of Library Science offers a graduate program which culminates in a Master of Arts degree in Education with a field in Library Science. This degree is granted in conjunction with the College of Human Resources and Education and the Graduate School.

The student will be admitted to the graduate program when he has met the following departmental requirements:

1. A Bachelor's degree from an approved college or university with evidence of 3 semester hours credit in Library Science 101 (Basic Reference) or equivalent:
2. A broad cultural background with a field of specialization.
3. Evidence of ability to undertake the completion of the Library Science program as well as promise of professional proficiency as shown by previous academic record.
4. A personal interview whenever possible.

*Degree Requirements:* The candidate for the Master of Arts in Education degree with a field in Library Science will be required to complete 30 semester hours of graduate study consisting of:

- (1) a. Eighteen graduate hours in Library Science, with an average of B, of which at least 3 hours will be in courses of "400" number; or
- b. Twelve graduate hours in Library Science with an average of B, of which at least 3 hours will be courses of "400" number, and 6 graduate hours in a related field (with faculty adviser approval) with an average of B.
- (2) a. Nine hours graduate courses in Education with an average of B, Audio-Visual Resources and Introduction to Education Research, and 3-6 hours of electives.
- b. A 3-hour problem report (C & I 391) in some phase of Librarianship; thus completing the 30 semester hours necessary for the degree.

<b>Required Courses in Education</b>	9 hr.
Ed. Psych. 260—Audio-Visual Resources in Education	3
Ed. Psych. 320—Introduction to Education Research	3
C & I 392—Problem in Education (Library Science)	3
<b>Electives from this group</b>	3-6 hr.
Ed. Psych. 330—Educational Measurements	3
Ed. Psych. 362—Organizing Programs of Audio-Visual Instruction	2
Ed. Found. 320—Philosophy of Education	3
C & I 301—Elementary School Curriculum	3
C & I 304—Secondary School Curriculum	3
Ed. Adm. 300—Public-School Organization and Administration	3
Ed. Psych. 440—Human Development and Behavior	3
Ed. Found. 340—History of Education	3
C&G 303—Basic Course in Guidance	3

## Library Science

### Lib. Sci.

201. **Reference and Bibliography.** I, II, S. 3 hr. PR: Consent. Basic reference books, dictionaries, encyclopedias, indexes, yearbooks, and other reference materials are studied and evaluated, with emphasis on the theory and practical experience of reference books. Required for Library Science majors.
203. **Library Materials for Children.** I, II, S. 3 hr. A survey of the development of children's literature with emphasis on modern books.
205. **Selection of Books and Related Materials for the Secondary School Library.** I, S. 3 hr. A survey of adolescent literature and other library materials adapted to the needs of high school students.
207. **Organization and Administration of the Instructional Materials Center in the Secondary School.** I, S. 3 hr. PR: Lib. Sci. 205, 223, for school librarians. A study of organization and administration, including planning equipment, routines, and schedules, and the role of the librarian in the instructional program.
222. **Field Practice.** I, II, S. 3 hr. PR: Lib. Sci. 1 or 201. Practical experience in a variety of public, school, and special libraries under the supervision of experienced librarians. Students must complete 100 clock hours. PR: Lib. Sci. 1 or 101, 203, or 205, 207 or 235, 223.
223. **Cataloging and Classification.** I, S. 3 hr. Basic principles and problems of cataloging and classification combined with practical experience in processing the various types of books and materials. Problems peculiar to the teacher-librarian will be considered.
224. **History of Books and Libraries.** I, S. 3 hr. A survey course, including the development of the book from early manuscript form, history of printing, printers, book illustration, bindings, and the library and its development.
235. **Organization and Administration of the Instructional Materials Center in the Elementary School.** II, S. 3 hr. PR: Lib. Sci. 223 for school librarians. Includes planning quarters; selection, acquisition and organization of books and other materials; supervision of library assistants; and relations with faculty, administration, and community.
321. **Public and Regional Library Service.** S. 3 hr. PR: Consent. Principles governing the administration of tax-supported public libraries and the development of larger units of service.
325. **Books and Reading for Adults.** II, S. 3 hr. Reading and evaluation of representative books in broad subject fields.



326. **Literature of the Social Sciences. II, S. 3 hr. PR: Consent.** Specifically designed to explore the theory of bibliographic organization and to identify social science reference sources.
327. **Literature of the Humanities. II, S. 3 hr.** Bibliographical and other reference sources in the major subject areas of the humanities, including religion, philosophy, fine arts, music, and literature.
328. **Literature of Science and Technology. II, S. 3 hr. PR: Consent.** A course designed to give the student a good working knowledge of the increasingly complex literature of science and technology.
330. **Library Resources for the School Curriculum. II. 3 hr.** Broadened experiences in both library and outside resources that lend themselves to curriculum enrichment, including guidance, remedial reading, textbooks, community resources, all phases of audio-visuals, etc. Presented to elementary and secondary teachers, as well as librarians, to help them give more effective services.
404. **Advanced Cataloging and Classification. II, S. 3 hr. PR: Lib. Sci. 223.**
409. **Seminar. I or II, S. 3 hr.**
410. **Special Topics. 3 hr.** A thorough study of some phase of library science based on the needs and interest of the individual.
411. **Problem Report. 3 hr. PR: 9 hr. of Education courses.**

## MATHEMATICS

The Department of Mathematics offers the Master of Arts and the Master of Science degrees, the Master of Arts degree being considered the predoctoral degree. The Master of Science degree offers more flexibility for those students who expect to enter the teaching field or who plan to become research assistants in industry, research laboratories, statistics centers, computing centers, the actuarial field, and other areas requiring specialized training in mathematics. Students completing this degree will not be recommended for continuation to the Ph.D. degree, nor will they be given support for a mathematics appointment in college.

Upon application for admission to Graduate School for the study of mathematics the student should make available to this Department his score on the Graduate Record Examination in Advanced Mathematics. If the student has not taken this examination he must do so at its first offering during his first semester of study. It is the responsibility of the student to acquaint himself with the requirements of the Graduate School, particularly with respect to deadlines for applying for degree-completing examinations, etc.

Students who expect to do graduate work in mathematics must have completed the equivalent of the mathematics requirements for an undergraduate major at West Virginia University. By permission, deficiencies in preparation may be made up after admission to the department by the completion of recommended undergraduate courses. It may be possible for a student to remove deficiencies by taking a comprehensive qualifying examination, the purpose of which is to determine his undergraduate background and to check on his fitness to pursue graduate work in the department. If deficiencies are to be cleared by test, this must be done either prior to his first registration or early in the first semester (or term) in which he enrolls.

Students are expected to maintain at least a 3.0 (B) average in their mathematics courses and to present at least a 3.0 (B) average in all course work offered in fulfillment of the degree requirements.

## Departmental Requirements and Policy

Candidates for the Master of Arts degree (prerequisite for doctoral work in mathematics) must complete a minimum of 30 hours credit, of which at least 24 must be in the "300" series of mathematics. At least six hours must be completed in each of three of the following fields: Algebra, Analysis, Geometry, and Topology.

The student should demonstrate proficiency in one foreign language prior to the final semester in which the degree requirements are met. This is done by arranging for the examination with the Foreign Language Examiner. Languages acceptable are: French, German, Russian, Italian. Others may be accepted, if special research and study require a knowledge of them (for example, Greek, Latin, Arabic, Polish, Hungarian, etc.).

A 3.0 (B) average is prerequisite to the writing of the comprehensive examinations in the areas of study, or the taking of the final oral examination.

A thesis, for which 6 hours credit is allowed, is expected. The date for the final oral examination for defense of thesis cannot be set sooner than the twenty-first day following that on which the thesis is placed in the hands of the student's Graduate Advisory Committee.

Candidates for the Master of Science degree must complete a minimum of 30 hours credit. The program will be worked out in conference with the Graduate Adviser's Committee, and will usually include at least 24 hours of courses selected from the "300" series in mathematics. No course work required for the removal of deficiencies may be included in the thirty hours offered for the degree.

Students who wish to do a minor part of their work in an applied area (for example, Physics, Engineering), or related areas in Education, should confer with the Graduate Adviser for prior approval of their Master's program. Cooperation with these departments and divisions is encouraged when the student will be served by this arrangement. The Department of Mathematics approves and promotes cooperation with other divisions of the University in developing graduate programs.

The Department also serves many related fields in that it embodies the areas of Algebra and Topology, Numerical Analysis and Computer Science, Analysis and Applied Mathematics, Probability and Statistics, and a variety of Mathematics Education programs.

## Mathematics

### Math.

- 201, 202. **Combinatorial Analysis. I, II.** 3 hr. per sem. PR: One year of calculus. Permutations, combinations, generating functions, principle of inclusion and exclusion, distributions, partitions, compositions, trees, and networks.
- 206. **Mathematical Logic 2. I or II.** 3 hr. PR: Math. 106. Formalization of the material in the previous term, the concepts of consistency, decidability, and completeness (equivalent to Philosophy 206).

- 208, 209. **Theory of Probability.** I, II. 3 hr. per sem. PR: Math. 17. Fundamental theorems. Development of density and distribution functions in the discrete and continuous cases. Classical problems and solutions. Moments, characteristics functions, limit theorems. Applications.
213. **Intermediate Differential Equations.** II. 3 hr. PR: Math. 140, 252 (or 258). Second-order linear equations, Riccati equation, complex variables. Series solutions. Equations of Fuchsian type, hypergeometric equation, confluence of singularities. Classical equations, applications.
214. **Partial Differential Equations.** I. 3 hr. PR: Math. 140. Primarily for engineers and scientists. One-dimensional wave equations, linear second-order equations in two variables, elliptic and parabolic equations, Fourier series, non-homogeneous and higher dimension problems, Sturm-Liouville theory, and approximate methods.
215. **Operational Methods in Partial Differential Equations.** II. 3 hr. PR: Math. 140, 252, (or 258). Laplace transformation, properties and elementary applications; problems in partial differential equations; complex variable; problems in heat conduction, mechanical vibration, etc. Sturm-Liouville systems. Fourier transforms.
- 220, 221. **Introduction to Numerical Analysis.** I, II. 3 hr. per sem. PR: Math. 17 and Math. 237 or Math. 245 or consent. Approximation of functions, iteration procedures, numerical integration and differentiation, numerical solution of linear and nonlinear equations, and ordinary differential equations, error analysis and pitfalls of computation.
- 230, 231. **Theory of Numbers.** I, II. 3 hr. PR: One year of calculus. Introduction to classical number theory, covering such topics as divisibility, the Euclidean algorithm, Diophantine equations, congruences, primitive roots, quadratic residues, number-theoretic functions, distribution of primes, irrationals, and combinatorial methods. Special numbers, such as those of Bernoulli, Euler, and Stirling.
232. **Mathematical Statistics.** II. 3 hr. PR: Math. 17. Discrete and continuous variables; correlation, regression, sampling theory; normal, chi-square, t, and F distributions; significance tests; analysis of variance.
235. **Introduction to Analysis and Topology.** I, II. 3 hr. PR: Math. 17 or consent. A study of sets, relations, functions; cardinal numbers, and orderings. Topological spaces including continuity, convergence, separation, compactness, and connectedness.
236. **Introduction to Algebraic Structures.** I, II. 3 hr. PR: Math. 17 or consent. Basic study of groups, rings, integral domains, fields, and polynomial rings. Special consideration of the real and complex fields and related topics.
237. **Introduction to Linear Algebra.** I, II. 3 hr. PR: Math. 17 or consent. A study of vector spaces, matrices, determinants, linear transformations, bilinear and quadratic forms, related topics.
243. **Projective Geometry.** II. 3 hr. PR: Math. 236, 237 or consent. Projective and affine spaces, transformation groups for planes. Introduction to axiomatic plane geometries.
245. **Vector Analysis.** I, II. 3 hr. PR: Math. 17. Primarily for engineers and scientists. Vector algebra, differential operators, curvilinear coordinate systems, Stokes' and Gauss' theorems, applications, linear systems of equations, matrices, determinants, quadratic forms, eigenvalues and canonical forms, and numerical inversions.
- 251, 252. **Introduction to Real Analysis.** I, II. 3 hr. PR: Math. 235 or consent. A study of sequences, limits, continuity, definite integral, convergence, differentiation, differentials, functional dependence, multiple integrals, line and surface integrals, and differential forms.



256. **Complex Variables.** II. 3 hr. PR: Math. 140. Complex numbers, functions of a complex variable; analytic functions; the logarithm and related functions; power series; Laurent series and residues; conformal mapping and applications.
- 257, 258. **Advanced Calculus.** I, II. 3 hr. per sem. PR: Math. 140. Primarily for engineers and scientists. Functions of several variables, partial differentiation, implicit functions, transformations; line, surface and volume integrals; point set theory, continuity, integration, infinite series and convergence, power series, and improper integrals.
260. **Advanced Real Calculus.** S. 3 hr. PR: Math. 17. Limits, series, metric spaces, uniformity, integrals.
- 264, 265. **Foundations of Algebra.** S. 2 hr. per sem. PR: Differential and integral calculus, or consent. Not open to students with credit for Math. 236. Introduction to algebraic structures: rings, the integral domain of integers, properties of the integers, fields, polynomials over a field, groups; matrices; linear systems; vector spaces; vector geometry; linear transformations; and linear programming.
- 266, 267. **Foundations of Geometry.** S. 2 hr. PR: Differential and integral calculus, or consent. A study of affine, projective, Euclidean, and non-Euclidean geometries.
- 268, 269. **Probability and Statistics.** S. 2 hr. per sem. PR: Differential and integral calculus or consent. Finite sample space, measure of the set of outcomes and probability of events, independent trials, functions on the sample space, approximations to the binomial distribution, elementary statistical inference, continuous sample space, limit theorems, stochastic processes, statistical models, and applications.
- 270, 271. **Introduction to Mathematics for the Elementary Teacher.** I, II. 3 hr. per sem. PR: Math. 56, 57 or consent. Systems of numeration; sets, relations, binary operations, decimal and other base systems; natural numbers, integers, rational numbers, and real numbers with emphasis on the algebraic structure of each; the notions of length, area, and volume; pythagorean theorem; and coordinate geometry. Not open to students with credit for Math. 170, 171.
280. **Introduction to Metamathematics I.** I. 3 hr. PR: Consent. Survey of the methodology of the deductive sciences with emphasis on the theory of proof and effective operations therein.
281. **Introduction to Metamathematics II.** II. 3 hr. PR: Math. 280. This course deals with recursive function theory. Godel's proof and associated results.
298. **Special Topics.** I, II, S. 1-12 hr.
299. **Seminar in Applied Mathematics.** I, II. 1-12 hr.
- 309, 310. **Group Theory.** I, II. 3 hr per sem. PR: Math. 236 or consent. Elementary group theory; Sylow theory, extended Sylow theory in solvable groups, Burnside's theorem on normal complements, transfer homomorphism. Representation theory. Emphasis throughout on finite groups.
- 311, 312. **Topology.** I, II. 3 hr. per sem. PR: Math. 252 or consent. A detailed treatment of topological spaces covering the topics of continuity, convergence, compactness, and connectivity; product and identification spaces, function spaces, and the topology in Euclidean spaces.
314. **Tensor Analysis.** II. 3 hr. PR: Math. 245, 252, (or 258). Vector concept developed from standpoint of algebraic invariants, surface geometry, tensor operators, curvature tensor. Ricci and Bianchi identities, applications of tensors to physical phenomena.
315. **Calculus of Variations.** II. 3 hr. PR: Math. 140, 252, (or 258). Maximum and minimum value of an integral, shortest distance, the brachistochrone problem, surface of revolution of minimum area, conditions for a relative minimum. Applications.

- 320, 321. **Special Functions.** I, II. 3 hr. PR: Math. 140, 252. Operational techniques; generalized hypergeometric functions: classical polynomials of Bell, Hermite, Legendre, Noerlund, etc. Introduction to recent Polynomial systems. Current research topics.
- 322, 323. **Analytic Number Theory.** I, II. 3 hr per sem. PR: Math. 230-231, 236-365. Selected topics in analytic number theory such as the prime number theorem; primes in an arithmetical progression; the Zeta function; the Goldbach conjecture.
- 331, 332. **Theory of Partial Differential Equations.** I, II. 3 hr. per sem. PR: Math. 252, or equivalent. Elementary concepts; Cauchy problems; the Cauchy-Kowalewski theorem; general existence theorems; associated surfaces; classification into elliptic, parabolic, and hyperbolic types; conditions required of coefficients for solvability; techniques for solution; distribution theory; and numerical methods.
- 351, 352. **Algebraic Geometry.** I, II. 3 hr. per sem. PR: Math. 236, 243. Foundations of affine geometry, the geometry of quadratic forms. Structure of the general linear group, symplectic groups, and orthogonal groups.
353. **Linear Algebra.** II. 3 hr. PR: Math. 237 or consent. Review of theory of groups and fields; linear vector spaces including the theory of duality; full linear group; bilinear and quadratic forms; and theory of isotropic and totally isotropic spaces.
- 354, 355. **Algebraic Theory of Semigroups.** I, II. 3 hr. per sem. PR: Math. 362-363, or equivalent. Ideal theory, matrix representation of semigroups, decompositions and extensions, simple semigroups, inverse semigroups, congruence relations, recent research.
- 356, 357. **Algebraic Topology.** I, II. 3 hr. per sem. PR: Math. 311, 362 (or consent). Singular homology and cohomology theories; homotopy theory and generalized homology theories.
- 360, 361. **Differential Geometry.** I, II. 3 hr. per sem. PR: Math. 236, 243. Elementary differential geometry. Transformation groups. Space curves. Geometry of surfaces.
- 362, 363. **Modern Algebra.** I, II. 3 hr. per sem. PR: Math. 236, or consent. Concepts from set theory and the equivalence of the Axiom of Choice, Zorn's Lemma and the Well-Ordering Theorem; a study of the structure of groups, rings, fields, and vector spaces; elementary factorization theory; extensions of ring and fields; modules and ideals; and lattices.
- 364, 365. **Theory of Functions of Complex Variables.** I, II. 3 hr. per sem. PR: Math. 252. Number systems, the complex plane and its geometry, fractions, powers, roots and transformations, Holomorphic functions, power series, elementary functions, complex integration, representation theorems, the calculus of residues, analytic continuation and analytic function, Elliptic functions, Holomorphic functions of several complex variables.
- 366, 367. **Algebraic Plane Curves.** I, II. 3 hr. per sem. PR: Math. 243. General theory of curves, singularities, associated curves.
- 376, 377. **Theory of Functions of Real Variables.** I, II. 3 hr. per sem. PR: Math. 235, 236, 252. Measure. Integration. Topics from functional analysis.
- 378, 379. **Functional Analysis.** I, II. 3 hr. per sem. PR: Math. 252 or consent. Linear spaces, seminorms, norms, metrics, Banach spaces, Hilbert spaces, uniform boundedness theorem, the open mapping theorem, the closed graph theorem, Rieaz's representation theorem, linear topological spaces, Hahn-Banach Theorem, convergence, convexity, duality, Banach algebras.
380. **Thesis.** I, II. 1-6 hr.
390. **Seminar in Analysis.** I, II. 1-12 hr.

- 391. Seminar in Algebra. I, II. 1-12 hr.
- 392. Seminar in Geometry. I, II. 1-12 hr.
- 393. Seminar in Number Theory. I, II. 1-12 hr.
- 394. Seminar in Special Functions. I, II. 1-12 hr.
- 395. Seminar in Topology. I, II. 1-12 hr.
- 497. Research. 1-15 hr.

#### Astronomy

##### Astron.

- 216. Astronomy for Teachers. S. 3 hr. Introduction to astronomy with special emphasis on the needs of physical science teachers and science club directors. Not open to students with credit for Astronomy 106.
- 255. Mathematical Astronomy. II. 3 hr. PR: Astron. 106, Math. 140. Development of the implications of Kepler's Laws and Newton's Law of Gravitation.

## PHILOSOPHY

Acceptance of a student will be based on (1) a Bachelor of Arts Degree with a minimum grade-point average of 3.0; (2) references from persons who can attest to, and advise on, the applicant's ability to complete the degree program. It is desirable, but not required, that the student also submit his score on the Graduate Record Examination.

### The M.A. Degree

To obtain the Master of Arts degree in Philosophy, (1) a minimum of 30 semester hours of course work beyond the Bachelor's Degree is required; (2) a reading knowledge of some foreign language, preferably French or German, is required; (3) a comprehensive examination in the areas of the History of Philosophy, Logic, Ethics, and Theory of Knowledge must be passed; (4) a thesis must be submitted, or, at the discretion of the Department of Philosophy, a written examination in the candidate's special field must be passed; and (5) an oral examination must be passed.

An average grade no lower than "B" in all courses taken at the graduate level is required.

#### Philosophy

##### Philos.

- 206. Mathematical Logic II. II. 3 hr. PR: Philos. 106 or consent. Formalization of the material in the previous term, the concepts of consistency, decidability, and completeness (equiv. to Math. 206).
- 223. Philosophy of Religion. I or II. 3 hr. PR: Philos. 123 or consent. Advanced topics in the philosophy of religion.
- 250. Social and Political Philosophy. I or II. 3 hr. PR: Philos. 150 or consent. Advanced topics in social and political philosophy.
- 253. Philosophy of Mathematics. I or II. 3 hr. PR: Philos. 106 or consent. Contemporary viewpoints in the foundations of mathematics.
- 264. Empiricism. I or II. 3 hr. PR: Philos. 102. Locke, Berkeley, and Hume.



- 268. **Rationalism.** I or II. 3 hr. PR: Philos. 102. Descartes, Spinoza, and Leibniz.
- 289. **Advanced Topics in Logic.** I or II. 3 hr. PR: Philos. 206 or consent.
- 302. **Philosophy of Science.** I or II. 3 hr.
- 303. **Theory of Knowledge.** I or II. 3 hr.
- 304. **Symbolic Logic.** I or II. 3 hr.
- 305. **History of Philosophy.** I or II. 3 hr.
- 306. **Metaphysics.** I or II. 3 hr.
- 310. **Ethics.** I or II. 3 hr.
- 321. **Seminar: Selected Topics.** 3-9 hr.
- 497. **Research.** 1-15 hr.

## PHYSICS

The Department of Physics offers graduate studies leading to the degrees of Master of Science and Doctor of Philosophy with research concentrations in the areas of solid state, nuclear, atomic, and theoretical physics, as well as in the areas of optics, electromagnetism, and applied physics. Both of these degrees require completion of a research project upon which a thesis or dissertation is based.

The general Graduate School requirements for a graduate degree are stated elsewhere in this bulletin. Graduate students in the M.S. program must receive credit for a minimum of 30 semester hours of course work as approved by the student's adviser. A 3.0 grade-point average is required. The 30 hours may include no more than 6 hours of research credit and do not include any courses which are taken to remove deficiencies in the student's undergraduate background. In addition to course work, a satisfactory performance on a written examination, completion of a thesis, and a final oral examination are required.

In general, to be admitted to the program for the Doctor of Philosophy, a student must pass a written admission examination. The program consists of basic graduate courses and specialized graduate courses related to a specific area of research. To complete the requirements for the degree, the student must demonstrate reading proficiency in one foreign language (French, German, or Russian), complete such courses as required by the department, pass the qualifying examination, submit an approved dissertation, and successfully defend his dissertation in a final oral examination.

Full details concerning the M.S. and Ph.D. programs may be obtained from the Department of Physics.

### Physics

- 201, 202. **Special Topics.** I, II. 1-3 hr. per sem. PR: Consent. Topics of current interest in physics presented on an elementary level.
- 221. **Optics.** II. 3 hr. PR: Calculus, Physics 11, 12 or equiv. A basic course in physical optics covering radiation theory, diffraction, interference, polychromatic waves, scattering, polarization, double refraction, and selected topics in quantum topics.
- 225. **Atomic Physics.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 12 or equiv. Relativistic mechanics, atomic structure and spectra.

- 231, 232. **Theoretical Mechanics.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 12 or equiv. Scalar and vector fields, curvilinear coordinate systems, kinematics of particle motion. Systems of particles, rigid body motion, conservative motion, central force fields, constraints. Lagrangian and Hamiltonian methods, oscillations, coupled oscillators.
- 233, 234. **Intermediate Electricity and Magnetism.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 12 or equiv. Electrostatics, magnetostatics, introduction to electrodynamics, and applications.
- 241, 242. **Mechanics Laboratory.** I, II. 1 hr. per sem. Experiments in mechanics; vibrations, damped oscillations, viscosity, thermal expansion. Determination of mechanical constants,  $g$ ,  $\gamma$ , Young's, and shear moduli.
- 243, 244. **Electricity Laboratory.** I, II. 1 hr. per sem. Experiments with electric and magnetic fields, electric and magnetic properties of materials, electromagnetic oscillations, waves, and radiation. Experience with electric and magnetic instruments and devices.
- 245, 246. **Modern Physics Laboratory.** I, II. 1 hr. per sem. Experiments in atomic, nuclear, and solid state physics. Emphasis is placed upon the learning of some of the techniques of experimental physics, methods of data evaluation, and error analysis.
- 247, 248. **Physics Seminar.** I, II. No credit. Required of junior, senior, and graduate physics majors. This program of lectures acquaints students with topics of current interest in physics.
249. **Optics Laboratory.** I. 1 hr. PR: Physics 11, 12 or equiv. Experiments in interference, diffraction, polarization, optical pumping, geometrical optics, and holography. Experience in using simple optical instruments.
251. **Introductory Quantum Mechanics.** I. 3 hr. PR: Physics 225 (or 231, 232). Physical observables as operators. Operator equations, particularly the Schrödinger equation. Applications to one dimensional motion, the harmonic oscillator, atomic structure and spin. Equation of motion.
252. **Introductory Quantum Mechanics.** II. 3 hr. PR: Physics 251. Approximate methods of calculation. Theory of scattering, radiation. Applications to atomic, molecular, nuclear, and solid state physics.
263. **Nuclear Physics.** I, II. 3 hr. PR: Calculus, Physics 11, 12 or equiv., Physics 225. The study of the characteristic properties of nuclei and their structure as inferred from nuclear decays and reactions, leading to a knowledge of nuclear forces and models.
- 271, 272. **Solid State Physics.** I, II. 3 hr. PR: Physics 225, or 125, 126. An introductory study of the properties of crystalline solids; includes crystal structure, binding, lattice vibrations and an investigation of thermal, electrical, magnetic, and optical phenomena based on the energy band theory.
283. **Thermodynamics.** I. 3 hr. PR: Calculus, Physics 11, 12 or equiv. The application of the fundamental laws of thermodynamics to physical and chemical systems.
284. **Kinetic Theory.** II. 3 hr. PR: Calculus, Physics 11, 12 or equiv. Introduction to the concepts of probability which lead to the derivation of the Boltzman, Fermi-Dirac, and Bose-Einstein statistics. The application of these statistics to physical and chemical systems.
- 287, 288. **Introduction to Mathematical Physics.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 12 or equiv. Introductory treatment of orthogonal functions, Laplace transforms, Green's function, coordinate transformations, elasticity, and hydrodynamics.
- 303, 304. **Special Topics.** I, II. 1-3 hr. per sem. PR: Consent. Specialized topics of current interest in physics.

313. **Introductory Electronics.** S. 3 hr. PR: 1 year of college physics. Primarily for Education majors; not for graduate credit for science majors.
318. **Dynamic Meteorology.** II. 3 hr. PR: Calculus, Physics 117 or equiv. Dynamics of lower atmosphere relating to transport and dispersion of foreign matter.
- 331, 332. **Advanced Classical Mechanics.** I, II. 3 hr. PR: Physics 233, 234, and differential equations. (Taught in alternate years; last given 1969-70). Lagrange and Hamilton form of equations of motion, rigid bodies, small and non-linear oscillations. Transformation theory, relativistic dynamics, and systems with an infinite number of degrees of freedom.
- 333, 334. **Advanced Electricity and Magnetism.** I, II. 3 hr. PR: Physics 233, 234, and differential equations. (Taught in alternate years; last given 1968-69). Electrostatic and magnetostatic boundary value problems. Maxwell's equations for time varying fields. Green's functions and integral representations; applications to radiation, diffraction, wave guides, plasma physics, and relativistic motion of charged particles.
- 341, 342. **Research Seminar.** I, II. 3 hr. PR: Consent. Discussion of problems encountered in particular fields of research and their relation to other areas of physics.
- 351, 352. **Quantum Mechanics.** I, II. 3 hr. per sem. PR: Physics 225 and 251. This course covers a wide range of topics of current interest at a level such that a student should be able to read basic research papers in many fields upon completion. Topics covered are: approximation methods, representation theory, angular momentum, relativistic quantum mechanics, time dependent perturbation theory, identical particles, scattering, molecules, solids, magnetism, and second quantization of bosons and fermions.
354. **Outline of Modern Physics.** S. 3 hr. PR: 10 hr. of college physics, 1 year of college math. Selected topics in modern physics. Primarily for Education majors; not open to physics majors.
- 355, 356. **Workshop for Physics Teachers.** SI, SII. 3 hr. per sem. PR: 1 year of college physics, 1 year of college math. Techniques of apparatus construction and demonstration. Primarily for Education majors; not open to physics majors.
357. **Photography.** SI. 3 hr. PR: 1 year of college physics or equiv. The physics and chemistry of photography with practical experience. Primarily for Education majors; not open to physics majors.
358. **Light.** SII. 3 hr. PR: 1 year of college physics or equiv. A demonstration course designed to illustrate the basic concepts covering light and optics. Primarily for Education majors; not open to physics majors.
- 361, 362. **Molecular Physics.** I, II. 3 hr. per sem. PR: Physics 225. A presentation of the theory of molecular structure and spectra.
410. **High Energy Physics.** I. 3 hr. PR: Physics 351, 352. Field theoretical interpretation of fundamental particles, interacting systems, S-matrix expansions, Feynman diagrams, and renormalization theory.
- 425, 426. **Atomic and Molecular Physics.** I, II. 3 hr. per sem. PR: Physics 225, 351, and 352. (Taught alternate years; last given 1969-70). Hartree-Fock theory application of angular momentum operators; group theory and j-symbols; Dirac theory; molecular vibrations; Breuckner-Goldstone applications to atomic structure, current topics.
453. **Advanced Quantum Mechanics.** I. 3 hr. PR: Physics 351, 352. Study of relativistic theory, many electron systems, introduction to quantum electrodynamics. (Taught alternate years; last given fall 1968).
- 463, 464. **Advanced Nuclear Physics.** I, II. 3 hr. per sem. PR: Physics 225, 226, and 251. Theory of nuclear forces, transformations and energy levels. (Taught alternate years; last given 1968-69).



- 471, 472. **Advanced Solid State Physics.** I, II. 3 hr. per sem. PR: Physics 271, 272, and 351. Detailed presentation of the theories of solids and its application to various topics: semiconduction, magnetism, etc. (Taught alternate years; last given 1969-70).
483. **Statistical Mechanics.** II. 3 hr. PR: Physics 283, 351, 352. Classical statistics; Boltzman, Fermi-Dirac and Bose-Einstein statistics, theory of fluctuations and applications to physical systems. (Taught alternate years; last given spring 1969).
487. **Advanced Mathematical Physics.** II. 3 hr. PR: Physics 287, 288, 351, and 352. Mathematical techniques applied to applications in physics: Group theory, functions of a complex variable, linear integral equations, geometry of finite dimensional vector spaces.
497. **Research.** I, II. 1-15 hr.

## POLITICAL SCIENCE

The graduate program in political science at West Virginia University extends through the Doctor of Philosophy degree. With reference to departmental objectives, the emphasis is placed upon more extensive and intensive training than is possible on the undergraduate level. This involves: (1) the development of a broader knowledge of the literature of political science; (2) some degree of specialization in one of the major areas of the disciplines; and (3) training in the identification and analysis of problems in governmental theory and practice. Graduate work in political science contributes to a general education and provides the foundation for more advanced work in the field. Leading professional possibilities for political science majors include teaching, the public service, and preparation for the legal profession.

### The Degree of Master of Arts

*Eligibility.* Regular applicants for the Master of Arts degree should present a minimum of 12 semester hours of undergraduate credit in political science and at least 6 additional hours in some cognate field, including history, economics, sociology, psychology, or social work. Students who do not meet the minimum requirements may, after consultation with the adviser, be admitted conditionally. In addition, a grade-point average of 2.5 should have been maintained as an undergraduate.

"Special" graduate students who are not working for an advanced degree may be admitted to courses for which they can satisfy the prerequisites.

*Course Requirements.* Admission to candidacy for the Master of Arts degree in political science is conditioned upon the completion of at least 30 hours of graduate work including a thesis. The candidate should present 18 semester hours of graduate course work in political science and 6 hours of similar work in a cognate field, such as economics, history, sociology, psychology, social work or education. Exceptions to this general rule may be made by the departmental adviser in the case of students with an inadequate background in political science who transfer from other institutions or from other departments in West Virginia University. Normally the thesis will carry 6 hours credit. A reading knowledge of a foreign language is highly desirable.

*Thesis and Final Examinations.* In his graduate program, the student will write a thesis on a subject falling within his field of specialization. Before

undertaking a thesis the student must have passed a two-hour written examination. Fulfillment of the thesis requirement includes the following steps: (1) selection of a problem or topic for research in the problem area; (2) extensive reading and collection of data in the problem area; (3) organization, analysis, and evaluation of the data; (4) writing the thesis in correct form; (5) acceptance of the completed thesis by a committee composed of at least three faculty members, one of whom shall not be a member of the Department of Political Science, and (6) passing an oral or written examination or both, administered by the committee on the thesis and the major and minor field.

Research on the thesis project will be done under the supervision of a staff member in whose field of specialization the thesis problem falls.

Students who fail to pass the final examination may appear for a second examination not earlier than the semester following that in which the first examination was given. It is contrary to departmental policy to give a third examination.

### **The Degree of Master of Public Administration**

This is a professionally oriented program designed to provide graduate professional training for administrative careers in the public service. The curriculum is designed to enable the student to understand and apply concepts and methods of the social and behavioral sciences to the development of public policies and the operation of governmental programs. The M.P.A. program seeks: (1) to provide orientation to the environment of public administration with particular attention to political institutions and processes; (2) to convey a general understanding of the major processes of public administration including program planning, organizational dynamics and leadership; and (3) to offer an opportunity for specialization in major managerial functions including financial administration, personnel administration, and organizational design.

*Eligibility.* Applicants for the Master of Public Administration degree must have a B.A. or B.S. degree with an overall grade-point average of at least 2.5. A student admitted to the program who has not had undergraduate courses in Public Administration will be expected to correct the deficiency prior to beginning graduate work by completing a special list of readings on which he will be examined orally.

*Course Requirements.* The student will be required to complete 36 hours of course and seminar work. A grade-point average of 3.0 will be required for graduation. Although a thesis is not required, the program of each student must include a minimum of four courses in which substantial research papers are required.

*Tool Requirements.* Candidates for the degree must demonstrate basic competence in either statistics or accounting by successfully completing an approved course in West Virginia University or another academic institution, or by passing an examination.

*Qualifying Examination.* During the last term of study, students in the M.P.A. program must pass a comprehensive examination for the degree. This examination will cover the core courses of the program and the elective courses selected.



## **The Degree of Doctor of Philosophy**

To gain admission to the program leading to the Doctor of Philosophy degree applicants must have completed the requirements for a master's degree, or the equivalent, at an approved institution as well as have demonstrated a capacity for graduate work in the Graduate Record Examination.

The program of courses will depend upon the individual needs of the student and the extent of his previous training in political science and related fields. Work leading to the doctoral degree consists of a minimum of three full years of graduate study—at least 60 semester hours after the bachelor's degree, in addition to research for the dissertation. Credits completed for a master's degree may be included in the doctoral program, with the exception of research credit granted for the master's thesis. Only credits with a grade of B or better in political science courses and C or better in the minor are accepted. A minimum of 36 hours or its equivalent in residence in full-time graduate study at West Virginia University is required.

With the approval of his adviser, a prospective candidate selects: (A) four major areas in the field of Political Science from the following six offered by the Department: (1) American National, State and Local Government; (2) Politics and Policy Development; (3) Public Administration; (4) Foreign and Comparative Government; (5) International Relations, Organizations, and Law; and (6) Political Theory; and (B) a minor area in a related field. At least one year prior to the conferring of the degree and after maintaining at least a 3.0 average in the major field and a 2.0 average in the minor, a prospective candidate is formally admitted to candidacy for the Doctor's degree upon satisfactorily passing written and oral examinations in the four major areas and the minor. To be eligible for these examinations, the prospective candidate must have demonstrated competency in two languages other than English (normally French and German) through examinations conducted by the Foreign Language Examiner for the Graduate School. Competency in statistics as evidenced by 6 hours with a grade of "C" or better in 200-, 300-, or 400-level statistics courses may be substituted for one language.

Upon admission to candidacy for the Doctor of Philosophy degree, the candidate must select a topic for a dissertation under the direction of his adviser, complete a dissertation which makes a contribution to knowledge in the candidate's area of concentration, and pass a final examination based primarily upon the dissertation. After successful completion of this final examination, the candidate will be recommended for the degree.

### **Political Science**

#### **Pol. Sci.**

- 200. **Research Materials and Techniques in Political Science. I.** 3 hr. A study of basic source materials in political science and of the techniques and methods of governmental research.
- 211. **Problems of American National Government. II.** 3 hr. This course is intended to give recognition to the major contemporary problems of government. Extensive reading of background materials as well as current literature in the field.
- 213. **American Constitutional Law and Theory.** 3 hr. PR: Pol. Sci. 2 or consent. Basic principles of American constitutional law as developed through inter-



pretation with special emphasis on constitutional theories and national development. Primarily for seniors and graduate students.

214. **Civil Rights and Liberties in the United States.** II. 3 hr. PR: Pol. Sci. 213 or consent. Study of the scope and meaning of civil liberty guarantees in the United States Constitution, as illustrated by cases involving original constitutional provisions, the federal Bill of Rights and Civil War Amendments with special attention to the rule of law; free speech, press, religion, assembly, and petition; personal security; racial discrimination; and the labor problems.
218. **Government and Business.** II. 3 hr. PR: Pol. Sci. 2 or consent. An examination of government regulations of the economy dealing with the origin and development of public policies, constitutional and political basis of regulation, relationships between political and economic institutions and processes, and an evaluation of the consequences of regulatory policies.
221. **West Virginia Government and Administration.** I, II. 3 hr. A study of the organization and operation of the state government of West Virginia.
225. **Municipal Government.** I. 3 hr. Legal basis, structure, operation, and problems of municipal government and municipal relations with other governmental units.
226. **Problems of State and Local Government.** II. 3 hr. An examination of current problems of state, county, and municipal governments. Students are expected to have completed Pol. Sci. 120 or its equivalent.
231. **History of Political Parties.** I. 3 hr. An examination of the growth of political parties in the United States. Analysis of issues in presidential campaigns as they relate to political party development. Offered in odd-numbered years.
232. **Public Opinion and Propaganda.** II. 3 hr. Analysis of techniques of sampling and measuring public opinion; detection of propaganda; the nature of propaganda and methods of the propagandist. Offered in alternate years.
233. **Current Political Issues.** I. 3 hr. An examination of political party platforms and the major issues of the political campaign. Students will be expected to examine background materials thoroughly. Offered in even-numbered years.
234. **The Legislative Process.** II. 3 hr. Structure and organization of legislative bodies. Powers of legislature. Detailed study of law-making procedures. The influence of outside forces. Offered in alternate years.
242. **Financial Administration.** I. 3 hr. PR: Pol. Sci. 140 or consent. Survey of methods and problems of fiscal management, including budgeting, accounting, tax administration, expenditure control, auditing, purchasing, and financial organization. Offered in alternate years.
244. **Administrative Law and Regulations.** II. 3 hr. PR: Pol. Sci. 140 or consent. Study of the law of administration, primarily by the case method, covering administrative powers, procedure in administrative adjudication and rule-making, discretion, judicial control, and administrative liability.
246. **Comparative Public Administration.** II. 3 hr. The theory and practice of public administration in diverse cultures and national political systems.
251. **Modern Dictatorships.** II. 3 hr. Politically undemocratic governments. Provides background of dictatorship generally, followed by treatment of several modern dictatorships.
252. **British Government and Politics.** II. 3 hr. Intensive study of British government with emphasis upon both internal and external policies, primarily during the twentieth century.
253. **Contemporary Governments of the Commonwealth.** II. 3 hr. Analysis of the political relationships between the members of the Commonwealth and a comparative study of the governments of the Dominions with particular reference to Canada and Australia.

254. **Governments of Asia. I.** 3 hr. Contemporary politics and governments of Asia.
255. **Governments of Latin America. I.** 3 hr. Comparative study of the major nations of Latin America.
256. **Governments of the Middle East. II.** 3 hr. The governments and political forces of the Middle East.
257. **Governments of Southeast Asia. II.** 3 hr. Survey of political institutions and governmental processes of the Southeast Asian countries with a special emphasis on the analysis of contemporary political problems of the governments surveyed.
258. **Politics of Africa. I.** 3 hr. A survey of the historical legacies and current political processes of tropical African countries designed primarily for secondary-level social studies teachers who are pursuing graduate training.
259. **Political Tour of Europe.** 6 hr. PR: Pol. Sci. 1 and 2 or consent. Examination of governments and politics in selected European countries. Lectures and discussions supplement observation while visiting these countries.
261. **International Organization. I.** 3 hr. PR: Pol. Sci. 160 or consent. Emphasis will be placed upon agencies created since the close of World War II. Some reference to development of international law and League of Nations.
263. **Public International Law. I.** 3 hr. Law governing relations among nations, including development of rules, means of enforcement, and conflicts between theory and practice.
264. **Conduct of American Foreign Relations. I.** 3 hr. Basic concepts about and factors influencing the decision-making process and the conduct of United States foreign policy, with special attention to the problems of ends and means of a democracy, pressure interest groups (i.e. the military-industrial complex and the administrative bureaucracy); recent theories, analytical tools, and methodology in the problem areas of conflict-resolution, nonconsensus situations, and inter-nation influence; regional patterns, problems, and prospects of United States policy in Europe, Africa, Asia, the Middle East, and the Soviet bloc since 1945.
265. **Basic Factors in Power Politics. II.** 3 hr. PR: Pol. Sci. 2 or consent. Analysis of factors of power in the nation-state system. Evaluation of nationalism and concepts of national interest in modern world politics.
266. **Soviet Foreign Policy. I.** 3 hr. PR: Pol. Sci. 150 or 160 or consent. Basic concepts about and factors influencing choice in the formulation and execution of Soviet foreign policy; the development and present patterns in Soviet foreign relations with key states and the United Nations; possible problems and prospects in further Soviet relations.
267. **Latin America in International Affairs. II.** 3 hr. PR: Pol. Sci. 160 or 255 or consent. Survey of the relations of Latin American States among themselves, with the United States of America, with the United Nations, with regional organizations, and with non-Western States. Analysis in depth of the Monroe Doctrine and its corollaries, and the Inter-American system.
268. **Inter-States Conflict in International Affairs. II.** 3 hr. PR: Pol. Sci. 160 or consent. The study of conflict in inter-state relations, in particular armed conflict between nations. Attention to the role of force, the impact of modern technology and nuclear weaponry, theoretical and research approaches to the causes and nature of conflict, and different modes of conflict control and resolution.
269. **Far Eastern International Relations. II.** 3 hr. PR: Pol. Sci. 160 or 254 or 257 or consent. A survey of the international relations of the Far Eastern countries with emphasis on the historic roots of recent conflicts, the competitive role of the United States and the Soviet Union, confrontation between the Communist and anti-Communist countries in the region, and the regional co-operation and security problems in the post-war period.

270. **History of Political Thought: Plato to Machiavelli. I.** 3 hr. Examination of major political ideas from the Greeks to sixteenth century with special emphasis upon development of natural law and western conception of justice.
271. **History of Political Thought: Machiavelli to Bentham. II.** 3 hr. PR: Pol. Sci. 270 or consent. Analysis of the political ideas which developed from the separation of faith and reason, the culmination of this movement in rational integral liberalism, and the origins of modern conservatism as expounded by Edmund Burke.
272. **Recent and Contemporary Political Thought. I.** 3 hr. An examination of integral liberalism and the forces leading to the decline of liberalism and a critical analysis of the Fascist and Communist ideologies with their threat to the traditions of western civilization embodied in Christianity and conservatism.
290. **Socio-Politics of Africa. I.** 3 hr. A comparative inquiry into political behavior and its social bases in tropical Africa, with particular reference to eastern and central Africa.
295. **The Politics of Planned Development. II.** 3 hr. A comparative study of the political aspects of directed economic and technological change, with special reference to the politics of national development planning and the development process.
310. **American Political Institutions. I.** 3 hr. PR: Pol. Sci. 2 or consent. Development of the Constitution, Congress, the Presidency, and the Supreme Court as institutions with special attention to current problems and issues.
315. **American Constitutional Development I. I.** 3 hr. PR: Pol. Sci. 2 or consent. A survey of American constitutional development, with special emphasis on the origins of constitutionalism here; liberty vs. government; mixed government; separation of powers; the problem of federalism and the Philadelphia Convention of 1787; the Marshall court and establishment of judicial review; Federalist vs. States Rights construction of the Constitution; Jacksonian influences; the Taney Court prelude to the Civil War, secession, and conflict, heralding constitutional change.
316. **American Constitutional Development II. II.** 3 hr. PR: Pol. Sci. 2, 315 or consent. Continuation of a survey in American constitutional development, with special attention to reconstruction, the Supreme Court, and the Fourteenth Amendment; laissez-faire and the commerce clause; stirrings of reform toward a constitutional revolutions under the New Deal; changing federal-state relationships; the impact of war upon constitutional interpretation; an expanding role for the president in domestic matters and foreign relations; the Warren court and triumph for libertarian activists over judicial restraintists in an era of civil liberties.
341. **Administrative Organization and Management. I.** 3 hr. PR: Pol. Sci. 140 or consent. Analysis of governmental administrative organization and reorganization and of such management functions as leadership, planning, coordination, public relations, and management improvement.
343. **Public Personnel Administration. II.** 3 hr. PR: Pol. Sci. 140 or consent. A survey of public personnel administration with particular attention to the merit system concept, career staffing, classification and salary administration, selection, manpower utilization, training, the rights and duties of employees, and the relationship between management and personnel specialists. Emphasis is given to psychological and human relations aspects of the work situation with attention to role and status, motivation, leadership, employee relations, and supervisor-subordinate interaction.
345. **Public Administration and Policy Development. II.** 3 hr. PR: Pol. Sci. 140 or consent. Analysis of decision-making and policy development in the administrative process by the case method.



350. **Comparative Government. I.** 3 hr. A comparative study of modern political institutions with particular attention to European constitutional government and politics.
373. **American Political Theory. II.** 3 hr. PR: Pol. Sci. 271 or consent. A survey of major political ideas and their influence upon American society and government from the seventeenth century to the present. Offered in alternate years.
374. **Problems in Contemporary Political Thought. II.** 3 hr. An intensive study of current trends in political thought through examination of the works of contemporary writers. Offered in alternate years.
391. **Leadership and Authority in Africa. II.** 3 hr. A comparative study of traditional, colonial, and contemporary political leadership and authority patterns in Africa south of the Sahara.
394. **The Theory of Political Development. I.** 3 hr. A survey of contemporary theories concerning political change and the relationship of political change to economic and technological development with particular reference to the new nations.
- 400, 401. **General Seminar in Political Science. I, II.** 1 hr. per sem. Open to properly qualified students in conjunction with Directed Reading and Research Courses for the presentation of papers for critical consideration; some attention will be given to methodology and bibliography.
403. **Internship. I, II.** 6-9 hr. per sem.; students may enroll more than once. PR: Consent. A work internship in government or political agencies designed to give students actual experience in a particular field of political science.
- 410, 411. **Directed Reading and Research in American National Government. I, II.** 2-4 hr. per sem.; students may enroll more than once.
419. **Seminar in American National Government. I.** 3 hr. PR: Consent.
- 420, 421. **Directed Reading and Research in State Government. I, II.** 2-4 hr. per sem.; students may enroll more than once.
- 425, 426. **Directed Reading and Research in Local Government. I, II.** 2-4 hr. per sem.; students may enroll more than once. PR: Pol. Sci. 225 or consent.
429. **Seminar in State and Local Government. I.** 3 hr. PR: Consent.
- 430, 431. **Directed Reading and Research in Politics. I, II.** 2-4 hr. per sem.; students may enroll more than once. PR: Pol. Sci. 130 or consent.
439. **Seminar in Politics and Policy Development. I.** 3 hr. PR: Consent.
- 440, 441. **Directed Reading and Research in Public Administration. I, II.** 2-4 hr. per sem.; students may enroll more than once. PR: Pol. Sci. 140 or consent.
442. **American Administrative Systems and Processes. II.** 3 hr. PR: Pol. Sci. 140 or consent. Analysis of the nature and processes of American public administration (political, legal, economic, and social conditions)—followed by a survey of organization, planning, budgeting, and personnel as the basic elements of an administrative system.
443. **Public Financial Administration. I.** 3 hr. PR: Pol. Sci. 140 or consent. An examination of the principal subjects of financial administration and their interrelationships. Particular attention is given to revenue systems, treasury and debt management, financial controls and inter-governmental fiscal relations.
444. **Public Program Planning. II.** 3 hr. PR: Pol. Sci. 140 or consent. A study of the design and management of governmental administrative systems. Special attention is given to systems theory, methods of system analysis, communications, management controls and methods of program evaluation.
445. **Public Budget Formulation and Execution. II.** 3 hr. PR: Pol. Sci. 140 or consent. The budget as a focus of policy formulation and an instrument of con-

trolling the work program. The process of budget creation and administration. The form of the budget. Budgetary practice in American governments.

- 446. **Public Program Seminar.** S. 6 hr. PR: Pol. Sci. 140 or consent. An analysis through case studies of the application of administrative processes to a major public problem. Students in the course are expected to produce substantial research papers on selected public problems.
- 449. **Seminar in Public Administration.** II. 3 hr. PR: Consent.
- 450, 451. **Directed Reading and Research in Comparative Government.** I, II. 2-4 hr. per sem.; students may enroll more than once.
- 459. **Seminar in Comparative Government.** II. 3 hr. PR: Consent.
- 460, 461. **Directed Reading and Research in International Relations.** I, II. 2-4 hr. per sem.; students may enroll more than once.
- 469. **Seminar in International Relations.** II. 3 hr. PR: Consent.
- 470, 471. **Directed Reading and Research in Political Theory.** I, II. 2-4 hr. per sem.; students may enroll more than once.
- 479. **Seminar in Political Theory.** II. 3 hr. PR: Consent.
- 480. **Thesis.** I, II. 2-6 hr.
- 497. **Research.** 1-15 hr.

## PSYCHOLOGY

*Admission.* Except in unusual circumstances, students are admitted only at the beginning of the Fall semester. Applications must be completed by the preceding February 15. Acceptance of the student will be based on: (1) adequate academic aptitude at the graduate level as measured by the Graduate Record Examination; (2) a minimum grade-point average of 2.5 (C+); (3) personal qualities in the applicant which are predictive of success in graduate study and satisfactory professional placement after graduation; (4) adequate preparation in the biological and social sciences, experimental psychology, and statistics. By permission, deficiencies in preparation may be made up after admission to the department. Students are expected to maintain a 3.0 (B) average in their psychology courses during the first graduate year, and to present a final 3.0 average in all psychology courses attempted.

*Special Graduate Students.* Graduate courses in psychology are open only to regular graduate students except by special departmental permission.

*The Master of Arts Degree (M.A.).* Two years of full-time study with a minimum of 48 hours of credit are required for the M.A. degree. Six hours of credit may be counted for the M.A. thesis if such thesis is required by the option chosen by the student. The following options are available for the M.A. degree:

1. *Intermediate Degree for Ph.D. Candidates.* Students who are candidates for the Ph.D. are expected to complete an M.A. thesis and will receive the M.A. degree upon completing the thesis and credit hour requirements.

2. *Psychological Research Technician.* This option will prepare the student to become a skilled research technician in behavioral sciences research programs. A thesis and broad training in research methodology and statistics will be required for this option.

3. *Teaching of Psychology at the Undergraduate Level.* No thesis is required under this option but supervised teaching at the college level is expected as part of the student's preparation.

4. *Professional M.A. Degree in Clinical Psychology.* This program prepares the student for work in hospitals, mental health clinics, school mental health programs, and the like. No thesis is required but the student must fulfill a field placement requirement during the summer intervening between the first and second year of graduate study. (An additional 12 hours of work in education will qualify students in this program for provisional certification as school psychologists in West Virginia).

*The Doctor of Philosophy Degree (Ph.D.).* The doctoral programs aim to prepare a small number of well-qualified psychologists for three types of careers: (1) teaching and research in experimental psychology, (2) teaching and research in life-span developmental psychology, and (3) teaching, research and practice in clinical psychology. The clinical program requires an academic year of supervised college teaching. A year of research field placement is taken by most students in the life-span developmental program.

Students are accepted for study toward the Ph.D. objective upon entry into the department. They are formally admitted to doctoral study only after completion of the Master's degree or its equivalent and may be subject to a screening examination to determine their readiness for doctoral work. During the first year of graduate work beyond the Master's degree and after demonstrating reading knowledge of a foreign language, the student will be admitted to a comprehensive preliminary examination in which he must demonstrate competence in his major area of specialization and a knowledge of such other areas of psychology as may be required of all graduate psychology students.

Upon passing the preliminary examination, the student will be formally promoted to candidacy for the doctorate. He will then be assigned a committee which will direct his further course work and his dissertation research, and will approve his internship setting.

After completion of a satisfactory dissertation and all other requirements, the candidate will take a final examination, written or oral, over his major and minor specialities and the dissertation.

## Psychology

### Psych.

201. **Personnel Psychology.** I or II. 3 hr. PR: Psych. 1 and Stat. 101 or equiv. Application of psychological principles and techniques to the problems of measurement and prediction of proficiency in industry and society. Topics include proficiency measurement, personnel selection by test and interviews, conditions of work and productivity, engineering psychology, work methods, and safety.
202. **Job Analysis.** I or II. 3 hr. PR: Psych. 201 or consent. Instruction and supervised practice in the preparation of job analysis and in the use of occupational descriptions. Of interest to students in psychology, guidance, engineering, management, and rehabilitation counseling.
213. **Directed Studies.** I, II. 1-3 hr. per sem. Individually supervised reading and/or research projects. (Graduate psychology students should register for such projects under Psych. 313).



219. **Survey of Psychology. I.** 1 hr. Overview of modern psychology with special reference to problems of graduate and professional training. Of primary interest to senior psychology majors and/or graduate students in other fields who are considering graduate work in psychology.
243. **Child Behavior. I and II.** 3 hr. PR: 9 hr. of psychology or graduate standing. Growth trends in behavior through adolescence, including development in the physical, intellectual, emotional, social, and personality areas. Primarily for non-majors.
244. **Adolescence and Early Adulthood. I or II.** 3 hr. PR: 9 hr. of psychology including Psych. 141 or CDFR 141, 142 or graduate standing or consent. Psychosexual, psychosocial, and other focal problems of development are stressed. The role of high school and higher education in growth and development is examined.
253. **Attitudes and Propaganda. I or II.** 3 hr. PR: Psych. 151 or consent. The nature of attitudes and opinions, attitude measurement, opinion changing, propaganda use and analysis, the social psychology of mass media, democratic values, and public opinion. Of interest to students in psychology, sociology, political science, and journalism.
262. **Group Psychometric Testing. I or II.** 3 hr. PR: Psych. 1 and Stat. 101 or equiv. Theory underlying the construction and use of psychometric measurement techniques for evaluating aptitudes, interests, attitudes, and personality.
263. **Introduction to Personality. I and II.** 3 hr. PR: 9 hr. of psychology or graduate standing. The development and significance of the personality concept in psychology including a survey of the major theories such as psychoanalytic, interpersonal, trait, and learning.
264. **Psychology of Adjustment. I and II.** 3 hr. PR: 9 hr. of psychology or graduate standing. Dynamic principles of human personality adjustment. Primarily for non-majors.
271. **Introduction to Clinical Psychology. I or II.** 3 hr. PR: 9 hr. of psychology or graduate standing. Review of concepts, techniques, and professional roles in clinical psychology. Of interest to advanced undergraduates and graduates in education, guidance, personnel, pre-medicine, and social work, as well as professional-oriented students in psychology.
281. **Abnormal Psychology. I and II.** 3 hr. PR: 9 hr. of psychology or graduate standing. Survey of the major behavioral disorders; neurosis, psychosis, and character disorders. Emphasis is placed on the developmental dynamics leading to these disorders, and upon their psychological treatment.
282. **Exceptional Children. I or II.** 3 hr. PR: 9 hr. of psychology including Psych. 141 or CDFR 141 or 142 or graduate standing. Study of children who present psychological problems because of: (1) exceptional mental retardation or advancement; (2) organic disabilities having behavioral consequences, such as cerebral palsy or deafness; (3) disorders of conduct associated with a typical personality functioning. Of special interest to those who regularly deal with children, such as teachers, guidance counselors and nurses.
304. **Leadership and Human Relations in Working Groups. I or II.** 1-3 hr. PR: Consent. Individual work related to either research or practice in the field of human relations training programs.
307. **Practicum in Industrial Interviewing. I or II.** 3 hr. PR: Psych. 201 or consent. An intensive review of principles of selection and validation as they relate to the interview. Practice interviews applying non-directive techniques in employment and other types of interview with critiques by the instructor.
311. **Statistical Methods in Psychology. I.** 3 hr. PR: Elementary statistics or consent. Basic concepts of statistical models, distribution, probability, random variables,

tests of hypotheses, confidence intervals, regression, correlation,  $t$ ,  $F$ , and  $\chi^2$  distributions, completely randomized analysis of variance. (Equivalent to Stat. 311 and Educ. Psych. 311).

312. **Analysis of Variance.** II. 3 hr. PR: Psych. 311 or equiv. Extension of basic concepts of statistical models, design of experiments, multiple classification models, factorial and split plot designs, simple covariance, orthogonal comparisons, and non-parametric statistics. (Equiv. to Stat. 312, and Educ. Psych. 312).
313. **Directed Study.** I and II. 1-3 hr. per sem. PR: Consent. Directed reading and research in special areas.
314. **Theory of Tests and Measurement.** I. 3 hr. PR: Elementary statistics or consent. Theory underlying psychological scaling, mathematical models, classical psychometrics. Includes introduction to concepts of reliability, validity, correlation and regression, multivariate analysis procedures.
315. **Multivariate Analysis.** II. 3 hr. PR: Psych. 311 or 314 or equiv. Correlational methods in psychology with application to typical research problems. Includes simple matrix algebra, multiple correlation, discriminant analysis, and an introduction to factor analysis. (Equivalent to Stat. 341).
318. **History of Psychology.** I or II. 3 hr. Traces the development of the science and concepts of psychology from their origin in philosophy, physiology, and medicine up to the modern era.
321. **Sensory Processes.** I or II. 3 hr. PR: Psych. 121 or 122 or equiv. Psychophysics of vision and audition are analyzed and related to current theories. Methods of research on sensory processes are reviewed.
322. **Conditioning and Learning.** I or II. 3 hr. PR: Psych. 122 and 121 or 123 or equiv. Review of current research in operant and classical conditioning. Controversial issues in learning are reviewed in light of recent research and theories.
323. **Perceptual and Cognitive Processes.** I or II. 3 hr. PR: Psych. 121 or 123 or equiv. Consideration of classical and contemporary research and theory on perception and cognitive processes, including concept formation and thinking.
324. **Motivation.** I or II. 3 hr. PR: Psych. 121 or 122 or equiv. Survey of experimental data and theory in the area of motivation as it relates to learning and personality.
331. **Physiological Psychology.** I or II. 3 hr. PR: Psych. 121, 122, and Zool. 271 or equiv. The biological bases for psychological activities such as perception, emotion, motivation and learning.
340. **Advanced Developmental Psychology.** I or II. 3 hr. PR: Psych. 141 and 314 or equiv. Research methods and substantive findings in the psychology of human development from birth to death, emphasizing developmental processes over the entire life-span.
347. **Comparative Psychology.** I or II. 3 hr. PR: Zool. 271 and Psych. 121 or 122. Comparison of the structure of representative animals of the various phyla in relation to differences in behavior.
351. **Advanced Social Psychology.** I or II. 3 hr. PR: Psych. 151 or consent. Consideration of contemporary theory and practice in social psychology.
352. **Group Dynamics.** I or II. 3 hr. PR: Psych. 151 or equiv. and consent. The psychological and sociological approaches to the dynamics of group processes. Includes discussion of leadership, informal communication and group processes, the relations of group aims to group organization, and the effects of the group on personality. (Equivalent to Sociol. 370).

363. **Personality Theory and Research.** I or II. 3 hr. PR: Psych. 263 and 314 or equiv. Intensive analysis of current research and theory in the psychology of personality.
379. **Professional Problems in the Practice of Psychology.** I or II. 2 hr. PR: Consent. Current problems in the practice of clinical psychology.
381. **Behavior Pathology.** I or II 3 hr. PR: Psych. 263 and 281 or consent. Advanced study of etiology and dynamics of severe behavior pathology.
397. **Master's Thesis.** I and II. 1-6 hr.
409. **Seminar: Industrial.** I or II. 2 hr. PR: Consent. Current research and problems in industrial psychology.
416. **Factor Analysis.** I or II. 3 hr. PR: Psych. 315 or consent. Alternate methods for factor extraction, communalities, rotation in orthogonal and oblique space, and the estimation of factor scores. (Equivalent to Stat. 446).
418. **Theory Construction.** I or II. 3 hr. PR: Consent. Consideration of the methods of theory construction and the role of theory in selected areas of psychology.
419. **Seminar: Methodology.** I or II. 2 hr. per sem. PR: Consent. Current problems in statistics and research methods.
423. **Human Learning.** I or II. 3 hr. PR: Psych. 122 and 123 or equiv. Historical and contemporary review of research and theory in verbal learning, transfer, mediation, retention and memory processes, including motor skill learning and verbal conditioning.
429. **Seminar: Learning.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in the psychology of learning.
431. **Advanced Physiological Psychology.** I or II. 2 hr. PR: Psych. 331. Neuro-anatomical and neurophysiological correlates of complex behavior.
432. **Physiological Psychology Laboratory.** I or II. 2 hr. PR: Psych. 331 and consent. Research techniques used in exploring the neural basis of behavior.
439. **Seminar: Physiological.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in physiological psychology.
443. **Infancy and Childhood.** I or II. 3 hr. PR: Psych. 340 or equiv. A theoretical study of psychological growth. Comparative and crosscultural research is emphasized.
445. **Maturity and Old Age.** I or II. 3 hr. PR: Psych. 340 or equiv. and consent. Cognitive and personality changes in middle and old age. Psychological reactions to physiological decrement and dissolution of family units. Emphasis on research and theory explaining aging phenomena.
447. **Developmental Learning Processes.** I or II. 3 hr. PR: Psych. 340 or equiv. A systematic review of research and theory related to the interaction of learning and maturational processes in children, retardates and adults. Selected topics covered include concept formation, discrimination learning, learning set, conditioning, verbal and language behavior, and other topics of contemporary interest.
448. **Advanced Personality Development.** I. 3 hr. PR: Psych. 340 and 363. Review and examination of current research and theory in personality development through the human life span.
449. **Seminar: Developmental.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in developmental psychology.
459. **Seminar: Social.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in social psychology.
469. **Seminar: Personality and Abilities.** I or II. 2 hr. per sem. Current research and problems in the areas of personality and trait measurement.



**NOTE:** All courses in the 470 series are professional skills courses open only to students in the Clinical Psychology program except by special departmental permission.

- 470. **Objective Methods of Personality Assessment. I.** 3 hr. PR: Consent. Observation, science and psychological assessment; the development of psychological tests; behavioral rating scales; behavioral assessment; the interview as an assessment instrument.
- 471. **Individual Intelligence Testing. II.** 3 hr. PR: Psych. 470 and consent. Intelligence testing, performance and non-language tests, assessment of central nervous system impairment, assessment of children and geriatric patients.
- 472. **Projective Personality Assessment Techniques. I or II.** PR: Psych. 470 and consent. Administration, scoring and interpretation of techniques for the assessment of private experience.
- 473. **Advanced Personality Assessment. I or II.** PR: Psych. 471, 472, and consent. Supervised practice in the diagnostic application of personality assessment techniques. Includes clerkship in various mental health facilities.
- 474, 475. **Behavior Modification. I, II.** 3 hr. per sem. PR: Psych. 322 and consent. Theory and practice of behavior modification based on learning theory and dynamic personality theory problems.
- 476. **Group Methods of Behavior Modification. I or II.** 3 hr. PR: Psych. 352 and consent. Application of principles of group dynamics, personality and learning theory to the use of group processes for the modification of abnormal behavior patterns.
- 477. **Clinical Psychology Practicum. I and II.** 1-6 hr. per sem. PR: Psych. 471, 472, and consent. Supervised practice of psychological techniques in clinics or institutional settings. Includes experience in psychological testing, interviewing, report writing, case presentation, interpretation of tests and supportive counseling. Primarily for students in the professional master's program in clinical psychology.
- 478. **Advanced Clinical Practicum. 1 and II.** 1-6 hr. per sem. PR: Psych. 474, 475, and consent.
- 479. **Seminar: Clinical. I or II.** 2 hr. per sem. PR: Consent. Current research and problems in clinical psychology.
- 489. **Seminar: Abnormal. I or II.** 2 hr. per sem. Current research and problems in abnormal psychology.
- 490. **Teaching Practicum. I and II.** 1-3 hr. PR: Consent. Supervised practice in the college teaching of psychology.
- 497. **Research. I and II.** 1-15 hr.

## **RELIGIOUS STUDIES**

- 290. **Seminar: Selected Topic. I or II.** 3 hr. PR: A 100 Religious Studies course or consent.
- 291. **Seminar: Selected Topic. I or II.** 3 hr. PR: A 100 Religious Studies course or consent.

## **SOCIOLOGY**

Candidates for the Master's Degree in Sociology must have an adequate undergraduate preparation in sociology or make up the deficit by taking courses which will not be credited toward the graduate degree. The latter may mean

an additional semester or summer term of study. If not taken for undergraduate credit, Sociology 201 and 211 (or equivalents), and a course in Statistics must be included in the program. Master's candidates are expected to earn 12 hours of seminar credit. A thesis is required of all candidates in addition to a total of 30 hours of course work. The candidate must pass a final examination, which may be oral, written, or both, at the discretion of the department. A part of this examination will test the candidate's general comprehension of the field of Sociology.

Current information regarding admission, either as a regular or special student, can be obtained by writing the Chairman, Department of Sociology.

## **Sociology**

### **Sociol.**

**Sociology 1, or equivalent, or Sociology 101, is prerequisite for all courses in the Sociology 200 series.**

201. **Types of Sociological Theory. I, II.** 3 hr. Examination of leading schools of sociological thought in our day.
203. **Collective Behavior. I or II.** 3 hr. Analysis of new group formation and behavior following social dislocation, social unrest, crowd behavior, and other forms of social contagion; the public and public opinion; social movements.
204. **Complex Organizations. I or II.** 3 hr. A sociological analysis of large-scale organizations, emphasizing their structure and functions. The course will examine the place in contemporary society of such organizations as the military, prisons, and hospitals.
205. **Social Stratification. I, II.** 3 hr. Description and analysis of various types of stratification systems, such as class and caste; social mobility and status-striving. The course emphasizes the place of status, prestige, and power in the structure of American society.
211. **Introduction to Social Research. I, II.** 3 hr. Trends in social research; examination of methods and techniques.
221. **Sociology of Childhood. I, II.** 3 hr. Adjustment of child to American culture.
222. **Principles of Community Development. I.** 3 hr. PR: Sociol. 1 or 101, or equiv., or consent. An applied course dealing with the principles and techniques of community organization and development.
223. **Sociology of Rural Life. I or II.** 3 hr. Social aspects of rural living. Characteristics of rural population, social structure, and institutional arrangements: family, community, education, religion, recreation, health, welfare, and local government.
231. **Society and Health. I.** 3 hr. The study of medicine as a complex form of social organization and of illness-related behavior. Although primary focus is upon analysis of contemporary North American health systems, interest also centers on historical and cross-cultural analysis.
232. **Sociology of Education. I, II.** 3 hr. An examination of education as a social institution; cultural and class influences on education; social roles and career patterns in the school system; the school and problems of the community.
233. **Industrial Sociology. I or II.** 3 hr. The sociology of industrial relations. The factory or business firm as a social system. Formal and informal relations within the plant.
240. **Social Change. I or II.** 3 hr. Sociological analysis of the major changes now going on in our society, of the forces underlying them, and of the tensions to which they give rise. Alternative future directions; rational manipulation and planning for social change.

241. **Population and Migrations.** I or II. 3 hr. Population theories; growth, composition, and distribution of American population; immigration and culture pluralism; internal migrations and their consequences.
251. **Cultural Dynamics.** I. 3 hr. The nature of culture and culture change. Historical trends in the study of cultural dynamics: focal interests, doctrines, and methods of study.
252. **Culture and Personality.** I, II. 3 hr. Significant interrelations between the individual and his culture.
253. **Cross-Cultural Studies in Development.** I or II. 3 hr. Comparative study of the processes of change in societies in the early stages of industrialization.
290. **Special Topics.** I, II, S. 1-6 hr. PR: Consent. (May be repeated for a max. of 9 hr.). Tutorial or seminar for selected strongly qualified students.
291. **Seminar.** I, II. 3 hr. PR: Consent. Primarily for sociology majors. Principles of sociology are emphasized.

**Prerequisite for all courses in the "300" and "400" series: Consent of chairman of graduate program committee.**

370. **Group Dynamics** (Same as Psych. 352.). I. 3 hr. An interdepartmental course, combining psychological and sociological approaches, in which the dynamics of groups in operation are considered.
390. **Seminar.** 3-9 hr.
391. **Seminar.** 3-9 hr.
393. **Tutorial.** 3-9 hr.
394. **Thesis.** I, II. 1-6 hr.
497. **Research.** 1-15 hr.

## **SPEECH**

### **The Degree of Master of Arts**

The Department of Speech offers work leading to the Master of Arts degree in General Speech, Rhetoric and Public Address, and Radio, Television, Film. Persons who possess a bachelor's degree from an accredited college or university may be admitted to the program. Although normally the entering graduate student has an undergraduate major in speech, qualified students from related areas are admitted with the understanding that any deficiencies in undergraduate preparation must be made up without credit toward the Master of Arts degree, or added to the credit requirements for the degree.

In addition to the general requirements of the Graduate School, the graduate student in speech must meet the following departmental requirements:

- I. Successful completion of the minimum number of required graduate hours as set forth in Program A or Program B below.
- II. Completion of Speech 401 and at least one Seminar in speech.
- III. Successful passage of three 3-hour written comprehensive examinations.
  - A. A "B" average is prerequisite to the writing of such examination.
  - B. No student shall be considered a candidate for the Master of Arts degree in speech, nor permitted to take the final oral examination, until he has passed the comprehensive examinations.



### **Program A—The Thesis Program**

1. Successful completion of at least 30 hours of graduate credit, 21 of which must be in the curriculum of the Department of Speech.
  - a. A maximum of 6 hours of research and thesis may be included in the 21 hours.
  - b. Problem topics in Speech 475 (Independent Study), and Speech 497 (Research), may not be expanded into a thesis.
2. Pursuit of courses in cognate fields upon the advice and approval of the Department Graduate Committee.
3. A thesis demonstrating original research and scholarly reporting.
4. Satisfactory completion of an oral examination on the thesis.

### **Program B—The Non-Thesis Program**

1. Satisfactory completion of a minimum of 36 semester hours of graduate credit, 24 of which must be in the curriculum of the Department of Speech.
2. Students emphasizing Rhetoric and Public Address or General Speech: Satisfactory completion of an oral examination relating to speech theory, principles, methodology, and philosophy.
3. Students emphasizing Radio, Television, or Film: Satisfactory completion of an oral examination relating to the philosophy, methods, and concepts within the area of specialization.

### **Speech**

221. **Persuasion. I.** 3 hr. PR: Speech 11 or 34 and consent. Study and practice in identification of factors motivating human behavior and belief, how to secure and hold attention, the uses of suggestion, the dramatization of ideas.
280. **Radio and Television Dramatic Writing. II.** 3 hr. PR: Speech 80, and Speech 184, or consent. Theory and practice of the basic principles of broadcast dramatic script writing. Experience in writing adaptations, and original comedy, tragedy, melodrama and fantasy type scripts, as well as poetry programs, serial dramas, children's shows and documentaries for commercial and educational purposes. Scripts are written for definite markets.
282. **Radio Workshop. I.** 3 hr. PR: Speech 181 or Speech 182, or consent. Brief discussion of techniques of radio production. Advanced laboratory experience in the production of University radio programs. Adapted to students groups and the public forum.
283. **Television Workshop. I.** 3 hr. PR: Speech 185 or consent. Brief discussion of techniques of television production. Advanced laboratory experience in the production of University television programs. Adapted to students interested in commercial and educational broadcasting.
284. **Radio and Television Program Planning. II.** 3 hr. PR: Speech 80 and consent. Analysis of the purpose and basic idea of a program in relation to audience composition. Requirements of effective structure. Practice in laying out program formats for all types of radio and television programming.
289. **Documentary Film Production. II.** 3 hr. PR: Speech/Journalism 189 and Speech 184 or Speech 280. A detailed study of the documentary as a film form and social commentary. Class will be divided into film units which will complete the production of a documentary film using professional equipment. Lab fee.
320. **Speech Composition. I or II.** 3 hr. PR: Speech 11 or 34 and consent. Emphasis on composing the speech for purposes of oral discourse. Consideration given to oral language as compared with written language, word choice, rhetorical structure and style. Study and critical analysis of selected speeches.

322. **Forms of Public Address.** II, S. 3 hr. PR: Speech 11 or 34 and consent. Combines the study of the essential principles of effective speaking with the application of those principles to specific speech occasions. The critical analysis, composition, and delivery of forensic, deliberative, and epideictic speeches.
323. **Advanced Group Discussion.** II, S. 3 hr. PR: Speech 120 or consent. Application of the principles and practices of the dynamics of groups to classroom teaching, conference and committee work, policy-determining interested in commercial and educational broadcasting.
325. **Directing the Forensic Program.** II or S. 3 hr. PR: Consent. Study of the principles and techniques of administering a forensic program, tournament direction, and conducting extracurricular activities.
330. **Classical Rhetoric.** I. 3 hr. PR: Consent. Critical study of rhetoric of classical times. Special attention given to Greek and Roman rhetors.
335. **American Public Address to 1860.** I. 3 hr. PR: Consent. Critical study of leading American speakers of the Colonial period through the Early National period, their biographies, speeches, and issues with which they dealt.
336. **American Public Address Since 1860.** II. 3 hr. PR: Consent. A critical study of leading American speakers, their speeches, and the issues with which they dealt, from the Later National Period to 1960.
370. **Psychology of Speech.** II. 3 hr. PR: Consent. Modern psychological principles of speech learning and usage. Influences of emotion, conditioning, and habit on listening, thinking, language, learning, judgments, imagery, and personality as factors in oral communication.
375. **Speech Problems of Children.** II or S. 3 hr. PR: Consent. Normal maturational development of listening and speaking skills, their relationships to language acquisition, and their influences upon achievement in reading and writing.
389. **Film Directing and Cinematography.** I or S. 3 hr. PR: Speech 289. An advanced study of motion picture production from the directional and cinematographic standpoint. Students will undertake individual film projects which will explore the possibilities of the film medium as an expressive art form. The class will produce a short 35 mm film. Lab fee.
401. **Introduction to Graduate Study in Speech.** I or S. 3 hr. PR: Graduate standing. Major emphasis is placed upon the principles of research, bibliographical data, and historical, descriptive, and experimental research methods useful in speech, broadcasting, and film. The course should be taken at the beginning of the graduate program.
433. **Special Topics.** I, II, S. 3-12 hr. (Limited to 3 hr. per sem.). PR: Consent. A thorough study of some special topic in speech, including British public address, rhetorical criticism, communication theories, and semantics.
439. **Seminar: Problems in Speech.** I, II. 3 hr. PR: Consent. Current research and problems in general speech and rhetoric and public address.
475. **Independent.** I, II, S. 1-3 hr. PR: Speech 401, a speech seminar, or consent of chairman of department. Open to graduate students in speech who are pursuing independent problems in that field.
489. **Seminar: Problems in Radio, Television, or Film.** I, II, or S. 3-9 hr. PR: Consent. Discussion and research into various issues and problems in the broadcast or film media. May be repeated to a total of 9 hours.
497. **Research.** I, II, S. 1-15 hr.

## STATISTICS AND COMPUTER SCIENCE

A Master of Science degree may be taken in either theoretical or applied statistics; a minimum of 36 hours credit is required for the degree. Students lacking prerequisite courses in mathematics may be required to take additional courses, possibly even lower-division courses for which graduate credit cannot be given.

A minimum of 18 hours in statistical methods, applications, and theory are required. A report, for which 3 hours credit may be granted, also is required. Additional graduate level courses will consist of elective courses in statistics or computer science, supporting mathematics courses, or courses in a specific field to which the candidate may wish to apply his statistical knowledge.

### Statistics

#### Stat.

201. **Intermediate Statistical Methods. II.** 3 hr. PR: Stat. 101. Extension of basic concepts of statistical models, elementary decision theory, estimation, random variables, one- and two-way classification models, analysis of variance, F-distribution, time series, seasonal and cyclical movements, simple and multiple linear regression and correlation analysis (equiv. to Econ. 226).
213. **Basic Statistical Analysis 1. I, II.** 3 hr. PR: Math. 16. Measures of central tendency and variation, probability, sampling, probability distributions, inference, tests of hypotheses, confidence intervals, analysis of variance, simple linear regression and correlation, and enumeration statistics (equiv. to I.E. 213).
214. **Basic Statistical Analysis 2. I, II.** 3 hr. PR: Stat. 213 or equiv. Single and multi-factor experimental designs; fixed, mixed and random effect models; split plot designs; multilinear and nonlinear regression and correlation analyses; and analysis of covariance (equiv. to I.E. 214).
215. **Statistical Computer Techniques. II.** 2 hr. PR: Math. 121 or I.E. 181 and pre- or corequisite Stat. 201, or consent. Extension of concepts and skills related to using digital computers for statistical analysis. In addition to programming statistical analyses and elementary simulations in the Fortran language, programs available in the Computing Center Statistical Program Library will be utilized.
231. **Sampling Methods. I.** 3 hr. PR: An introductory course in statistics. Methods of sampling from finite and infinite populations, choice of sampling unit, sample survey design, estimation of confidence limits and optimum sample size, and single and multi-stage sampling procedures.
261. **Statistics and Probability 1. I.** 3 hr. PR: Math. 16. Probability, discrete and continuous probability distributions, expectations, sums of random variables, sampling distributions, point and interval estimation, tests of hypotheses.
262. **Statistics and Probability 2. II.** 3 hr. PR: Stat. 261. Statistical inference and decision theory; properties of hypotheses; bivariate and multivariate distributions; least squares procedures.
291. **Special Topics. I, II, S.** 1-6 hr. Advanced study of special topics in statistics.
311. **Statistical Methods 1. I, II.** 3 hr. PR: Math. 3. Basic concepts of statistical models, distributions, probability, random variables, tests of hypotheses, confidence intervals, regression, correlation, transformations, F and  $\chi^2$  distributions, analysis of variance of one- and two-way classification models, multiple range tests, missing plots, and sample size (equiv. to Psychol. 311; and Ed. Psych. 311).



312. **Statistical Methods 2. I, II.** 3 hr. PR: Stat. 201, Stat. 213, or Stat. 311. Extension of basic concepts of statistical models, design of experiments, multi-way classification models, factorials, split plot design, simple covariance, orthogonal comparisons, multiple linear and nonlinear regression and correlation analysis, chi-square, and non-parametric statistics (equiv. to Psychol 312 and Ed. Psych. 312).
321. **Design of Experiments. I.** 3 hr. PR: Stat. 214 or Stat. 312. Extension of basic concepts of statistics to the more complicated models and use of samples, design and analysis of experiments over time and space, fractional replications, incomplete block design, cross-over designs, lattice designs, and least square analysis for designs with unequal subclass numbers.
333. **Nonparametric Statistics. II.** 3 hr. PR: An introductory course in statistics. Single sample tests; for related samples, two independent samples,  $k$  related samples,  $k$  independent samples; and measures of correlation.
341. **Multivariate Statistics 1. I.** 3 hr. PR: Stat. 201, Stat. 213, or Stat. 311. Introduction to elementary matrix operations, partial and multiple linear and non-linear correlation and regression analyses, and introduction to discriminant analysis (equiv. to Psych. 315).
342. **Multivariate Statistics 2. II.** 3 hr. PR: Stat. 341 or equiv. This course includes a discussion of the multivariate normal distribution, tests of hypotheses about the sample mean vectors and variance-covariance matrices from a multivariate normal distribution, and analysis of variance of multiple responses in basic statistical designs.
361. **Theory of Statistics 1. I.** 3 hr. PR: Math. 17. Probability and random variables, univariate and multivariate probability distributions, expectations, moment, marginal and conditional distributions, independence, correlation, transformations, and functions of random variables.
362. **Theory of Statistics 2. II.** 3 hr. PR: Stat. 361. Estimation including bias, consistency, efficiency and sufficiency, hypothesis testing, distribution-free problems, order statistics, linear models and analysis of variance and special distributions.
446. **Factor Analysis. II.** 3 hr. PR: Stat. 341. Alternative methods for factor extraction, communalities, rotation in orthogonal and oblique space, and estimation of factors scores (equiv. to Psychol. 416).
451. **Linear Statistical Models 1. I.** 3 hr. PR: Stat. 312 or equiv. and Stat. 362 or consent. Statistical concepts, multivariate normal distribution, distribution of quadratic forms, linear models, general linear hypothesis, polynomial models, functional relationships and regression models.
452. **Linear Statistical Models 2. II.** 3 hr. PR: Stat. 451. Experimental design models, factorial models, incomplete block models, assumptions of experimental design models, and components of variance for fixed, random, and mixed models.

## Computer Science

More extensive offerings in Computer Science are under active consideration. The Department should be contacted about these.

## Computer Science

291. **Special Topics. I, II.** 1-6 hr. Advanced study of special topics in computer science.

## **THE COMMITTEE ON AFRICAN STUDIES**

Since 1961, West Virginia University has served as an AID Contractor responsible for agricultural education in East Africa. With one exception, the contracts have been directed toward agricultural education below the degree or professional level. To support the objectives of these contracts, WVU has employed expert staff from its colleges, divisions, and off-campus programs, under the direction of the University Office of International Programs. Fifty-eight University employees have served one or more two-year appointments in Africa.

Further, WVU has followed the practice of employing experts required in supporting roles not directly related to the active phase of its contractual commitments, in teaching and research positions on its home campus.

Since the early part of 1967, the University has expanded its technical and academic competence regarding Africa from solely the agricultural sciences to include the social sciences and humanities. Presently, several units of the Colleges of Arts and Sciences, Commerce, Creative Arts, and Human Resources and Education are actively engaged in the teaching and research of African and Africa-related subjects. New faculty are regularly added to complement African studies, and the University is sponsoring serious African research and curriculum development within the arts, sciences and humanities as well as within agriculture. Special educational programs in African studies are beginning to proliferate on both the Evansdale and Downtown campuses.

West Virginia University has gained experience in developing a rapport with foreign students—African and others. Over seventy-five students from Africa have earned certificates, diplomas, and degrees in formal subject areas at the University; and increasing numbers are enrolling every year. More than two hundred short-term participants have engaged in studies and other activities at the University.

### **The Committee on African Studies**

The Committee on African Studies was formally organized in 1969 to fulfill two basic requirements: (1) to blend the agricultural expertise of long-standing with the newer programs of study and research into a unified whole of course offerings and systematic research; and (2) to make available the knowledge present in the social sciences and arts concerning Africa to existing and prospective University programs of African technical assistance.

Moreover, it is within the Committee's mandate to broaden its activities to include other parts of the world experiencing problems of development and human change similar to those of Africa. Although the University's assistance, instructional and research programs, now relate primarily to East Africa, they do have a wider application. The concepts and philosophy developed in all of these activities have utility throughout Africa and, with suitable modification, should be of benefit to other developing areas of the world, including the Appalachian Region.

## **Academic Goals of the Committee**

### **Instructional Goals**

In their broadest immediate sense, the instructional goals of the Committee are: (1) to provide for WVU an interdisciplinary competence in the teaching of the complex human and technological aspects of African development; and (2) to secure and maintain the procedural means for students in many fields readily to avail themselves of these interdisciplinary African and development studies.

### **Research Goals**

The research goals of the Committee are: (1) to provide interdisciplinary means through which significant contributions to the advancement of knowledge in African and development studies can be made by University faculty; and (2) to provide the opportunity for undergraduate and graduate students to pursue investigations, including field research, which will benefit greatly their learning experiences at WVU.

## **The Africana Library Collection**

For several years, the University Library has accumulated African materials in a variety of disciplines; so that presently the Africana collection contains nearly 6,000 volumes, exclusive of periodicals, and is capable of supporting undergraduate and graduate research up to and including the doctoral level within several natural and social sciences.

## **Academic Programs of the Committee**

### **Degree Programs**

The Committee does not offer either undergraduate or graduate degrees in African studies as such; but rather stimulates the interdisciplinary study of Africa and development on the part of students who are formally associated with departments in the natural and social sciences and humanities.

### **Special Academic Programs and International Study**

The Committee provides opportunities for special non-degree study in Africa-related subjects at the University, as currently sponsored by the Office of International Programs; and is working to develop international study programs within Africa for University faculty and students.

### **African Speakers Program**

For three years, the University has sponsored speakers on Africa to come and speak before University audiences. This program will be continued and expanded by the Committee on African Studies.

### **Research and Fellowship Programs**

At present, the University, through the Office of International Programs, is sponsoring thirteen field research projects in East Africa, for faculty within the natural and social sciences and humanities. In addition, one graduate teach-



ing fellowship in African studies (Political Science) is currently offered within the University. It is the intention of the Committee to enlarge these opportunities and especially to provide interdisciplinary facilities for student field research at the graduate level.

*Further information concerning the Committee and its program can be obtained from:*

Newton M. Baughman  
Office of International Programs  
2112 Agricultural Sciences Building

Rodger Yeager  
Department of Political Science  
114 Woodburn Hall

## AFRICAN AND RELATED GRADUATE COURSES OF STUDY

### College of Agriculture and Forestry

#### *Division of Animal and Veterinary Sciences*

AIVS 420—Special Topics.

VS 497—Research.

#### *Faculty of Agricultural Biochemistry*

Agr. Biochem. 320—Special Topics.

Agr. Biochem. 497—Research.

#### *Division of Forestry*

Forest Management 470—Special Topics.

Forest Management 497—Research.

#### *Division of Plant Sciences*

Agron. 420—Special Topics.

Agron. 497—Research.

Genet. 420—Special Topics.

Genet. 497—Research.

Hort. 420—Special Topics.

Hort. 497—Research.

Plant Path. 420—Special Topics.

Plant Path. 497—Research.

#### *Division of Resource Management*

Agr. Econ. 213—Economic Development.

Agr. Econ. 420—Special Topics.

Agr. Econ. 497—Research.

Agr. Educ. 320—Special Topics.

Agr. Educ. 497—Research.

Agr. Mech. 420—Special Topics.

Agr. Mech. 497—Research.

### College of Arts and Sciences

#### *Department of Geology and Geography*

Geogr. 246—Geography of Africa.

### *Department of History*

- Hist. 229—History of Africa: Pre-Colonial Africa.
- Hist. 230—History of Africa: European Dominance and Independence.
- Hist. 425, 426—Readings, Seminar in African History.

### *Department of Political Science*

- Pol. Sci. 258—Politics of Africa.
- Pol. Sci. 290—Socio-Politics of Africa.
- Pol. Sci. 295—Politics of Planned Development.
- Pol. Sci. 391—Leadership and Authority in Africa.
- Pol. Sci. 394—Theory of Political Development.
- Pol. Sci. 400, 401—General Seminar in Political Science.
- Pol. Sci. 440, 441—Directed Readings and Research in Public Administration.
- Pol. Sci. 449—Seminar in Public Administration.
- Pol. Sci. 450, 451—Directed Readings and Research in Comparative Government.
- Pol. Sci. 460, 461—Directed Readings and Research in International Relations.

### *Department of Sociology*

- Sociol. 205—Social Stratification.
- Sociol. 223—Sociology of Rural Life.
- Sociol. 240—Social Change.
- Sociol. 241—Population and Migrations.
- Sociol. 290—Special Topics in Anthropology.

### *College of Commerce*

- Econ. 210—Comparative Economic Systems.
- Econ. 213—Economic Development. (Same as Agr. Econ. 213).
- Econ. 219—Seminar in Economics.
- Econ. 375—Economic Development.
- Econ. 379—Seminar in Economic Development.

### *Creative Arts Center*

#### *Division of Music*

- Music 230—Music of Africa.

### *College of Engineering*

- Agr. Eng'g. 420—Special Topics.
- Agr. Eng'g. 497—Research.

### *College of Human Resources and Education*

#### *Division of Education*

- C & I 270—Special Problems in Comparative Education.

# College of Commerce

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The College of Commerce offers graduate programs in business administration and economics. The program in business leads to the degree of Master of Business Administration (M.B.A.). These programs are supervised by the Graduate Faculty in Business Administration and students in them are administered by the Director of Graduate Programs in Business.

Graduate programs in economics lead to the degrees of Master of Arts (M.A.) and Doctor of Philosophy (Ph.D.). These programs are supervised by the Graduate Faculty in Economics and students in them are administered by the Director of Graduate Programs in Economics.

All work for a graduate degree must be completed within a period of seven years. An extension of this period must be approved in writing by the appropriate graduate faculty and the dean of the Graduate School.

## **Graduate Program in Business Administration**

To receive approval to enter the M.B.A. program an applicant must have a baccalaureate degree from an accredited college or university, with an undergraduate average of at least 2.5 (of a possible 4.0) or a baccalaureate degree and an acceptable score on the Admission Test for Graduate Study in Business. (Persons in the latter category are approved to enter the program on a probationary basis.) To assure that all students in the program have the same foundation in business, the applicant must have completed the following courses:

- Principles of Accounting (2 semesters)
- Principles of Economics (2 semesters)
- Principles of Marketing
- Principles of Management (or Industrial Management)
- Business Finance
- Principles of Statistics

A student without the necessary prerequisite courses may be approved to enter the M.B.A. program on probation subject to removal of any deficiencies prior to his taking the required graduate courses. All applicants for the M.B.A. program must submit scores in the general aptitude test of the Graduate Record Examination and the Admission Test for Graduate Study in Business. While scores on the Admission Test for Graduate Study in Business must be submitted before an applicant can be considered for the M.B.A. program, students may be admitted provisionally without the Graduate Record Examination providing that they take it on the first date it is offered after admission. All applicants for approval to enter the M.B.A. program must be received in the Admissions Office of the University at least one month prior to the date for which enrollment is requested.



## Master of Business Administration (M.B.A.)

The candidate's program of courses will be planned with the assistance of a faculty adviser and must have his approval. The M.B.A. degree requires a total of 36 hours of graduate credit, including the following courses:

### Fall Semester<sup>o</sup>

- Accounting 301—Managerial Control, 3 hr.
- Economics 301—Managerial Economics, 3 hr.
- Economics 302—Research and Reports, 1 hr.
- Management 301—Administrative Practices, 3 hr.
- Management 302—Quantitative Business Analysis, 3 hr.

### Spring Semester<sup>oo</sup>

- Economics 302—Research and Reports, 2 hr.
- Finance 313—Financial Administration, 3 hr.
- Management 313—Production Administration, 3 hr.
- Marketing 313—Marketing Administration, 3 hr.

### Summer Session

- Management 323—Administrative Policy, 3 hr.<sup>ooo</sup>

<sup>o</sup>PR: The undergraduate courses listed above, or consent.

<sup>oo</sup>PR: The required courses offered in the fall semester, or consent.

<sup>ooo</sup>PR: The required courses offered in both the fall and spring semester, or consent.

The candidate will also complete 9 semester hours of elective courses selected with the approval of his adviser. Of these electives, at least 3 hours must be in a graduate course of the College of Commerce at the 300 level, preferably in a graduate seminar in business. No thesis is required, but writing is emphasized in all courses. The candidate must pass a comprehensive examination covering the material in the required courses. This examination is normally taken during the semester in which the required courses, with the exception of Management 323, will be completed and may be repeated only once.

The M.B.A. program requires that the student maintain a grade-point average of at least 3.0 (B) on all work taken as a graduate student while enrolled in the College, including prescribed work taken to remove undergraduate deficiencies. A student whose cumulative grade-point average falls below 2.5 will be placed on probation. If his average is not brought up to 2.5 by the end of the following semester, he will be suspended. A grade below "C" in any course taken while enrolled as a graduate student will result in suspension from the graduate programs of the College. In addition, the student must maintain a 3.0 (B) average in all work counting toward the graduate degree.

## GRADUATE PROGRAM IN ECONOMICS

All applicants must take both the general aptitude test and the economics advanced test of the Graduate Record Examination. Prior to admission to the program, students are required to have completed at least 18 semester hours of

course work in economics. Six of these hours may be in principles of economics, at least 3 hours must be in statistics, and not more than 3 hours may be from the functional fields of accounting, finance, marketing, management, etc. A minimum grade of "C" is required in each of the courses taken to meet the 18 hour economics requirement. Applicants must have a 2.5 grade-point average or better ( $A = 4.0$ ) for all undergraduate work completed.

Students who do not meet these entrance requirements may be admitted on probation subject to the correction of the deficiencies at the beginning of the program. Deficiencies in undergraduate preparation must be removed without graduate credit. No student will be admitted on probation unless his grade-point average is at least 2.0.

To qualify for the masters degree, graduate students in economics must earn a cumulative grade-point average of 2.75 in all courses attempted during their tenure as graduate students at West Virginia University. To qualify for the Ph.D. degree, graduate students in economics must earn a cumulative grade-point average of 3.0 (B). A student whose cumulative grade-point average falls below 2.5 will be placed on probation. If his average is not brought up to 2.5 by the end of the following semester, he will be suspended. A grade below "C" in any course taken while enrolled as a graduate student will result in suspension from the graduate programs of the College of Commerce.

### **Master of Arts (M.A.)**

The candidate's program of courses will be planned with the assistance of the faculty adviser and must have his approval. The M.A. degree requires a total of 30 semester hours of graduate credit, including 18 hours in the graduate core curriculum in economics and an acceptable thesis (6 hours). The student must make a passing grade on a qualifying examination in statistics, or alternately, a minimum grade of "B" in Advanced Statistics (Econ. 226 or equivalent courses).

*The following courses constitute the graduate core curriculum in economics:*

#### **Economics**

310—Advanced Micro Theory I, 3 hr.

311—Advanced Micro Theory II, 3 hr.

312—Advanced Macro Theory I, 3 hr.

313—Advanced Macro Theory II, 3 hr.

316—History of Economic Doctrines and Analysis, 3 hr.

320—Quantitative Analysis, 3 hr.

### **Doctor of Philosophy (Ph.D.)**

At least three years of full-time graduate work beyond the baccalaureate degree are usually required to qualify for the doctorate. Two of the three years of residence must be at West Virginia University, including at least two consecutive semesters in actual residence as a full-time graduate student.

The Ph.D. degree is not awarded for the mere accumulation of course credits nor for the completion of the specified residence requirements. A minimum, however, of 36 hours of graduate work in economics at the 300-level is

required for all candidates for the Ph.D. degree in economics. These must include 18 hours in the graduate core curriculum in economics listed above.

Three additional hours must consist of a seminar in the candidate's field of concentration. The remaining 15 hours will be selected by the student with approval of his adviser.

For admission to candidacy for the Ph.D. Degree the student must:

1. Satisfy the foreign language requirement of the Graduate School.
2. Demonstrate proficiency in statistical technique by successful completion of a qualifying examination or, alternatively, by achieving a minimum grade of "B" in Advanced Statistics (Econ. 226 or equivalent courses.)
3. Successfully complete preliminary examinations in four fields which include economic theory (Micro Theory, Macro Theory, and History of Economic Doctrines), two other fields of concentration in economics and one other field in economics or in an outside area. The selection of an outside field must be done with the advice and consent of the student's graduate committee.

When an applicant has successfully passed his qualifying examinations, he will be formally promoted to candidacy for the doctoral degree. Admission to candidacy must precede the final examination for the doctoral degree by at least one academic year.

The candidate must submit a thesis pursued under the direction of the Graduate Faculty in Economics on some problem in the area of the candidate's major interest. The thesis must present the results of the candidate's individual investigation and must embody a definite contribution to knowledge. It must be approved by a committee of the Graduate Faculty in Economics. An oral examination on the thesis is required.

After approval of the candidate's thesis and satisfactory completion of other graduate requirements, he shall have a final examination by his advisory committee. See the general regulations for graduate degree beginning on page 28 for further information on the dissertation, residence requirements, final examination, request for degree, and attendance at commencement.

## Accounting

211. **Accounting Systems. I.** 3 hr. PR: Accounting 112. The adaptation of accounting procedures to the demands of the firm, with emphasis on theoretical factors important to efficiency and internal control; system surveys and reports, the design of forms, office machine applications.
213. **Income Tax Accounting. I.** 3 hr. PR: Accounting 112 or consent. Tax theory and practice as developed from the regulations of the Internal Revenue Service; problems in preparation of tax returns for individuals, partnerships, and corporations.
214. **Income Tax Accounting. II.** 3 hr. PR: Accounting 213. A continuation of Accounting 213.
216. **Advanced Cost Accounting. II.** 3 hr. PR: Accounting 115. Advanced work in the application of cost theory and procedures to cases and problems which emphasize the managerial use of cost information.
217. **Auditing Theory. I or II.** 3 hr. PR: Accounting 112. Auditing fundamentals; objective standards and procedures; introduction to working-paper techniques; procedure statements of the American Institute of CPAs.



218. **Auditing Practice.** I or II. 3 hr. PR: Accounting 217. Application of auditing theory and procedures, with emphasis on decisions which invoke judgment and are important in independent audits; audit working papers and reports; case studies.
224. **Advanced Accounting Problems.** I or II. 3 hr. PR: Minimum of 18 hours in accounting with an average grade of "B" or higher. Analysis and solution of representative CPA problems.
230. **Advanced Accounting Theory.** I or II. 3 hr. PR: Accounting 112, 115, and consent. Critical analysis of accounting concepts and standards with emphasis on their origin, development, and significance.
301. **Managerial Control.** I. 3 hr. PR: Accounting 52 and Econ. 125. The use and significance of the quantitative techniques of accounting, statistics, and budgeting for planning, control, and decision making.
329. **Seminar in Accounting.** I or II. 3 hr.
497. **Research.** I, II. 1-15 hr.

## Economics

### Specialized Courses

205. **Current Economic Problems.** S. 3 hr. PR: Econ. 51 and 52 or consent. For students in Education only. A course designed to acquaint public school teachers with reliable source material in economics and to instruct them in studying current economic problems.
265. **Economics of Social Security.** I or II. 3 hr. PR: Econ. 51 and 52 or consent. An examination and analysis of our social and political efforts to provide economic security, including an examination of the parallel developments of private insurance.
301. **Managerial Economics.** II. 3 hr. For students in the M.B.A. Program. An analysis of markets and the problems of management in appraising business conditions and in adjusting to changes in product demand, costs, level of output, and profits.
302. **Research and Reports.** I, II. 1-3 hr. For students in the M.B.A. Program. A study of sources of business information and research procedures, with application in the preparation of reports.

### Economic Theory

210. **Comparative Economic Systems.** I or II. 3 hr. Structure and processes of existing economic systems throughout the world including review of basic principles of free enterprise, socialistic, communistic, and fascistic societies. Comprehensive analysis based on current and recent experiments in these economies.
211. **Micro Economic Analysis.** I. 3 hr. A study of price and output determination and resource allocation in the firm under various competitive conditions.
212. **Macro Economic Analysis.** II. 3 hr. An analysis of the forces which determine the level of income, employment, and output. Particular attention is given to consumer behavior, investment determination, and government fiscal policy.
216. **History of Economic Thought.** I or II. 3 hr. Economic ideas in perspective of historic development.
310. **Advanced Micro Theory I.** I. 3 hr. Theory of production and allocation, utility theory, theory of the firm, pricing in perfect and imperfect markets, models of firm's operations.
311. **Advanced Micro Theory II.** II. 3 hr. PR: Econ. 310. General equilibrium analysis, distribution theory, welfare economics.

- 312. **Advanced Macro Theory I.** I. 3 hr. Classical, Keynesian, and Post-Keynesian theories.
- 313. **Advanced Macro Theory II.** II. 3 hr. PR: Econ. 312. Model of economic growth and fluctuations.
- 316. **History of Economic Doctrines and Analysis.** I. 3 hr. Study of the writings of the major figures in the development of economic doctrines and analysis.
- 319. **Seminar in Economics.** II. 3 hr.

#### Quantitative Economics

- 220. **Introduction to Quantitative Analysis.** I or II. 3 hr. PR: Econ. 125. Study of the principal mathematical techniques employed in economic analysis; an introduction to econometrics.
- 226. **Advanced Statistics.** II. 3 hr. PR: Econ. 125 or equivalent. An advanced approach to statistical analysis with emphasis on probability, inference, and multi-varied statistical techniques.
- 320. **Quantitative Analysis.** II. 3 hr. PR: Econ. 220 or consent. Linear programming, input-output analysis, game theory, decision theory, and dynamic models.
- 325. **Econometrics.** I or II. 3 hr. Specification, statistical estimation, and verification of economic models. Problems of applications of econometric analysis.
- 329. **Seminar in Economic Analysis.** I or II. 3 hr.

#### Monetary Economics

- 330. **Monetary Economics.** I or II. 3 hr. Sources and determinants of the supply of money; the demand for money for transactions and speculative purposes; general equilibrium theory of money, interest, prices, and output; the role of money in policy.
- 334. **Seminar in Monetary Economics.** I or II. 3 hr.

#### Public Finance

- 241. **Public Finance.** I, II. 3 hr. Governmental fiscal organizations and policy; taxes and tax systems with particular emphasis upon the Federal Government and the State of West Virginia.
- 340. **Theory of Public Finance.** I or II. 3 hr. Systematic study of the economic role of government in a mixed economy with regard to resource allocation between the public and private sectors, the influence of government upon income distribution and upon economic stability and growth.
- 344. **Seminar in Public Finance.** I or II 3 hr.

#### Public Regulation and Control

- 245. **Government and Business.** I or II. 3 hr. Government in its role of adviser and umpire; analysis of governmental policies and practices affecting business.
- 246. **Transportation.** I, II. 3 hr. Development of an inland transportation system and relations and policies of transport agencies.
- 345. **Public Regulation and Control.** I or II. 3 hr. Economic analysis of the public control of enterprises under the jurisdiction of federal and state regulatory authorities.
- 349. **Seminar in Public Regulation and Control.** I or II. 3 hr.

## International Economics

- 250. **International Economics.** I or II. 3 hr. Development of trade among nations; theories of trade, policies, physical factors, trends, and barriers in international economics.
- 350. **Advanced International Economics.** I or II. 3 hr. Contemporary theories of international economics; analysis of current problems in world trade and finance.
- 354. **Seminar in International Economics.** I or II. 3 hr.

## Regional Economics

- 255. **Regional Economics.** I or II. 3 hr. Analysis of factors that promote or deter the economic growth of a region, with emphasis on such matters as population shifts, economic base studies, industrial location analyses, input-output techniques, regional income estimation, local multiplier and cycle concepts, and the role of government in regional growth.
- 355. **Advanced Regional Economics.** I or II. 3 hr. Regional income and flow of funds estimation, regional cyclical behavior and multiplier analysis, industrial location and analysis, techniques of regional input-output measurement, the impact of local government reorganization on the level of regional public service and conomic development.
- 359. **Seminar in Regional Economics.** I or II. 3 hr.

## Labor Economics

- 261. **Trade Unionism.** I or II. 3 hr. PR: Econ. 160 or consent. Analysis of the structure, government, attitudes, and policies of organized labor; the implications of union policy.
- 262. **Collective Bargaining.** I or II. 3 hr. PR: Econ. 160 or consent. Theory and practice of collective bargaining; including contract issues, types of relationships, and the role of government policy.
- 263. **Economics of Wages.** I or II. 3 hr. PR: Econ. 160 or consent. Determination of wage levels and structure; the functioning and organization of labor markets.
- 360. **Advanced Labor Economics.** I or II. 3 hr. Economic effects of trade unionism; measurement and impact of unemployment; the functioning of labor markets; the operation of labor unions; selected aspects of collective bargaining; issues in social legislation.
- 364. **Seminar in Labor Economics.** I or II. 3 hr.

## Economic History

- 270. **Strategic Factors in American Economic Growth.** I or II. 3 hr. Regional impact of changing methods of production and distribution.
- 370. **Economic History: Regional Economic Development of the United States.** I or II. 3 hr. The regional development of the Pacific Coast, Southwest, Lower South, the Old Northwest and New England.
- 314. **Seminar in Economic History: The Emergence of Modern Europe.** I or II. 3 hr.

## Economic Development

- 213. **Economic Development.** I or II. 3 hr. A comprehensive study of the problems, changes, and principal policy issues faced by non-industrialized countries in the process of economic development.



375. **Economic Development.** I or II. 3 hr. An examination of the theory, problems, and policy issues relating to the process of economic development.

379. **Seminar in Economic Development.** I or II. 3 hr.

#### Other Economic Courses

390. **Independent Reading in Economics.** I or II. 3-6 hr. Supervised readings in special areas.

497. **Research.** I, II. 1-15 hr.

#### Finance

216. **Risk Management.** II. 3 hr. PR: Finance 115 or consent. A study of the transferable risks with which the entrepreneur must deal. Emphasis is on the process by which decisions are made for the handling of these risks, including an examination of the contributions and limitations of the insurance system.

313. **Financial Administration.** II. 3 hr. PR: Finance 111. A study of problems in business finance including those related to the financial structures of corporations and the working-capital and fixed-capital needs of a firm.

329. **Seminar in Finance.** I or II. 3 hr.

497. **Research.** I, II. 1-15 hr.

#### Management

213. **Problems in Business Administration.** I or II. 1-3 hr.

216. **Personnel Management.** I, II. 3 hr. Principles and practices in the direction, coordination, and remuneration of manpower.

225. **Business Policy.** I, II. 3 hr. PR: Senior standing and consent. Integrated study of policies, organization, facilities, and control techniques of business enterprises.

301. **Administrative Practices.** I. 3 hr. PR: Management 111 or consent. A study of interpersonal relationships through which administration becomes effective. Emphasis is on the human factors, but the influences of economic and technological factors are also considered. Focus is on the importance of harmony between individual needs and organizational goals.

302. **Quantitative Business Analysis.** I. 3 hr. PR: Econ. 125 or equiv. A review of probability and Bayesian Statistics, multiple correlation, linear programming, and planning and control techniques with an introduction to data processing through computer solution to problems in these areas.

313. **Production Administration.** I. 3 hr. PR: Management 111. The review and application of analytical techniques to complex manufacturing problems.

323. **Administrative Policy.** II. 3 hr. PR: Consent. An integrated study of policies, organization, facilities, and control techniques of business enterprises.

329. **Seminar in Management.** I or II. 3 hr.

497. **Research.** I, II. 1-15 hr.

#### Marketing

210. **Industrial Purchasing.** I. 3 hr. PR: Marketing 111. A survey of corporate procurement problems facing modern purchasing executives.

215. **Marketing Research.** II. 3 hr. PR: Marketing 111. The utilization of marketing research techniques in the solution of practical marketing problems.

313. **Marketing Administration.** I. 3 hr. PR: Marketing 111. The analysis of problems met by management in distributing goods and services efficiently to consumers.
329. **Seminar in Marketing.** I or II. 3 hr.
497. **Research.** I, II. 1-15 hr.

## Creative Arts Center

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The Creative Arts Center incorporates within a single administrative unit the Divisions of Music, Art, and Drama. The administrative entity was established in 1964. The \$7 million first phase of the Creative Arts Center building was completed in the fall of 1968. This new building, when all phases are constructed, will fulfill the academic needs of the disciplines and also provide full facilities through its theatres and galleries for public performances and exhibits. Each of the divisions offers various graduate degree programs in its appropriate areas.

### DIVISION OF MUSIC

Prospective graduate students in music are required to have completed the appropriate curriculum of undergraduate study in music at West Virginia University, or its equivalent at another institution of recognized standing. For acceptance as a degree student the applicant must:

1. For the Master of Music degree, have an average of 2.5 on all undergraduate study; for the Ph.D. and Doctor of Musical Arts, have an average of 3.0 on the Master's degree or equivalent.
2. Submit to the Division of Music a score of at least 35 on the Miller Analogies Test.
3. Demonstrate by audition or a tape recording a level of attainment on the major instrument no more than one grade-level below the stated entrance level as indicated for the respective curriculum.\*

Applicants accepted for degree study must take Entrance Tests in Theory and Music History, and audition on piano. These tests and auditions will be given two days prior to registration. The results of these might indicate the need for remedial study.\*\* Applicants for the areas of Theory and Composition will be tested more specifically in counterpoint (both 16th and 18th century), form, instrumentation, and orchestration. Applicants seeking acceptance as composition majors must also submit representative compositions for evaluation and approval.

\*See "Graduate Applied Music Requirements," a listing available at the Applied Music office of the Division of Music.

\*\*Recent graduates of the Division of Music will be admitted on their past record without these entrance examinations, unless these examinations are deemed necessary by the Dean of the Creative Arts Center.

Applicants who have been admitted to the Graduate School, but whose averages and test scores do not meet the qualifications outlined above, will be accepted as Special Graduates. If upon completion of at least 15 semester hours of graduate study they have maintained a "B" (3.0) average, and when any previous undergraduate deficiencies are removed, such Special Graduates will be accepted as degree students.

The Miller Analogies Test may be taken at any time by appointment at numerous college testing centers around the country. (The Division of Music can supply addresses upon request.) If a tape recording is submitted, it must be of a high quality, 7½ ips, and clearly marked as to name, titles of compositions, and types of tracks used (*i.e.*, half track, quarter track mono, quarter track stereo, etc.). The best recordings still leave much to be desired and a personal audition is encouraged if at all feasible. The auditions are administered, on Saturdays, on announced dates six times throughout the school year and summer. These dates are available upon request. For each semester or the summer session the last date is approximately six weeks prior to registration.

## **The Degree of Master of Music**

Candidates must establish an overall grade-point average of 3.0 (B) within a maximum of 36 hours. Applicants will be admitted to candidacy upon the completion of 12 semester hours of graduate study. No student will be admitted to candidacy until he has removed all undergraduate deficiencies and maintained a 3.0 (B) average in all graduate work completed.

Candidates for the Master of Music degree may major in one of five fields: Music Education, Applied Music, Theory, Composition, History of Music.

Graduate students majoring in Music Education will be allowed one of four options, to be determined in consultation with their adviser: (1) Thesis option; (2) Recital option (if the candidate demonstrates at least grade level of 8½ ability on his major instrument when entering); (3) Thirty-six hour option; and (4) Certification option (intended for persons possessing a bachelor's degree with a major in music). For the first three options there are the following requirements:

1. Thirty graduate hours for thesis and recital options, thirty-six graduate hours otherwise, with an average of 3.0 (B).
2. Required courses: Music 410, Music 444, Music 446, one course each in the areas of theory and music history, and either Music 440 or Music 442.
3. Achievement of grade level 8 on the major instrument.
4. Passing of an oral examination in areas of music education, music history, and music theory.
5. Successful completion of a 4-hour thesis or 2-hour recital for the thesis and recital options, respectively.

For the certification option, a special selection of approximately 21 hours is made in cooperation with the Division of Education to satisfy certification requirements. The other hours, to make a total of 36, are electives to provide a good background for teaching. Undergraduate courses may be required to make up deficiencies in areas of performance or conducting.



A representative public recital is required of candidates majoring in Applied Music. Composition majors must submit as a thesis a composition in a large form.

All candidates for the Master of Music degree are required to participate at least two clock hours per week for two semesters (or summer terms) in a performing group selected with the approval of the adviser.

A general comprehensive oral examination must be passed by all candidates for the Master of Music degree. Candidates may repeat this examination after a three-month period. The results of the second oral examination will normally be considered final. The examining committee will decide immediately after an unsuccessful second attempt whether a petition for a third attempt will be granted.

The following are the five curricula:

History of Music	Hr.	Theory	Hr.
(Prerequisite: 12 undergraduate hours in Music History and Literature, such as Music 33, 34, 330, 331, 332, 333, or equivalents.)		M. 430—Intro. to Musical Biblio. . . . .	2
M. 430—Intro. to Musical Biblio. . . . .	2	One of the following . . . . .	3
M. 431—Intro. to Musical Biblio. . . . .	2	M. 432—Music in Middle Ages—3	
M. 432—Music in Middle Ages . . . . .	3	M. 433—Music in Renaissance—3	
M. 433—Music in Renaissance . . . . .	3	M. 436—Music in Baroque Period—3	
M. 436—Music in Baroque Period . . . . .	3	M. 437—Music in Classic and Romantic Periods—3	
M. 437—Music in Classic and Romantic Periods . . . . .	3	M. 449—Psychology of Music . . . . .	3
M. 467—Analytical Techniques . . . . .	3	M. 467—Analytical Techniques . . . . .	3
M. 497—Research . . . . .	2	M. 470—Orchestration . . . . .	2
M. 497—Research (thesis) . . . . .	4	M. 475—Pedagogy of Theory . . . . .	3
Electives* . . . . .	5	M. 481—Nonserial Techniques of 20th Century Composition . . . . .	2
		M. 482—Serial Techniques . . . . .	2
		M. 497—Research (thesis) . . . . .	4
		Electives . . . . .	6
	30		30

Music Education (with thesis)	Hr.	Applied Music	Hr.
M. 410—Conducting . . . . .	3	M. 400—Applied Music (major instrument) . . . . .	8
M. 440—Choral Techniques, or M. 442—Instrumental Techniques	2	Two of the following courses . . . . .	6
M. 444—Music Education . . . . .	3	M. 432—Music in Middle Ages—3	
M. 446—Introduction to Research in Music Education . . . . .	3	M. 433—Music in Renaissance—3	
M. 497—Research (thesis) . . . . .	4	M. 436—Music in Baroque Period—3	
Music Electives (at least one course each in theory and music history)** . . . . .	15	M. 437—Music in Classic and Romantic Periods—3	
		M. 332—Studies in Contemporary Music—3	
		A course (or courses) from the Theory and/or Composition offerings—minimum . . . . .	3
		One of the following courses . . . . .	2
		M. 496—Lecture Recital—2	
		M. 497—Research—2	
		M. 498—Recital . . . . .	4
		Music Electives (no more than 4 hr. in the major applied music area) . . . . .	7
	30		30

Composition	Hr.
One of following	3
M. 432—Music in Middle Ages—3	
M. 433—Music in Renaissance—3	
M. 436—Music in Baroque Period—3	
M. 437—Music in Classic and Romantic Periods—3	
M. 467—Analytical Techniques	3
M. 460—Composition	6
M. 470—Orchestration	2
M. 475—Pedagogy of Theory	3
M. 481—Nonserial Techniques of 20th Century Composition	2
M. 482—Serial Techniques	2
M. 497—Research (thesis)	4
Electives	5
	<hr/> 30

\*To be eligible for graduation the candidates must demonstrate completion of grade level 8 on their major instrument.

\*\*To be eligible for graduation, the candidates must present evidence of musicianship through accomplishment of grade level 8, or through demonstration of skill in conducting, or through demonstration of various performance skills important in elementary school teaching (recorder, guitar, piano, Orff instruments, etc.).

## The Degree of Doctor of Philosophy

**Admission.** Applicants to the program leading to the degree of Doctor of Philosophy must present necessary credentials for evaluation of previous training and experience to the Graduate Department of the Division of Music. This includes a score on the Miller Analogies Test, a transcript of all grades, and must show proof that the applicant has had a minimum of 28 semester-hours in liberal arts studies. Prior to admission to the program the Department may, at its discretion, require the applicant to take entrance tests in various fields of music, or it may require the applicant to present himself for a personal interview. Under normal circumstances the applicant must have attained an average grade of B in courses taken for his Master's degree. However, if sufficient professional experience should warrant, the Department may waive the requirement of a B average or may grant an applicant conditional admittance subject to the satisfactory completion of certain specified courses or the attainment of a specified grade-point average within a semester's work.

**Candidacy.** Graduate students meeting the requirements of the Division of Music and the general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are:

1. Demonstrate the ability to read German and French (only one of the two applicants in Music Education). (Upon the recommendation of the adviser and with the approval of the Dean of the Graduate School, one other language may be substituted for French or German).
2. Pass written examinations satisfactorily to show:
  - a. Broad knowledge in "Theory" and "Music History and Literature."
  - b. Knowledge in depth in the field of specialization.
3. Pass satisfactorily a comprehensive oral examination covering the entire field of music.

4. Present and have accepted an outline and prospectus of the dissertation.

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. Should the applicant fail the written examinations he may apply to take them again after a minimum period of three months. Should the applicant fail the comprehensive oral examination he may be examined again after a minimum period of six months. The results of the second oral examination will be considered final.

*Fields of Specialization.* Candidates shall select a program within one of the following fields of specialization: (1) Theory; (2) Music Education; (3) Musicology. In addition, a minor field consisting of a minimum of 12 credit hours in another field of music or a cognate field will be required of all candidates and will be chosen with the approval of the adviser. If the candidate's specialization is in Musicology, the minor field will ordinarily be chosen from an appropriate area of Humanities.

*Curriculum.* The exact amount and nature of course work to be undertaken by a candidate will be determined by the adviser with the approval of the doctoral committee in the light of the candidate's previous preparation and his field of specialization.

*Residence.* In general, the requirements for the degree of Doctor of Philosophy contemplate at least three years of full-time graduate work. A minimum of two semesters is required in residence in full-time graduate study at West Virginia University beyond the master's degree or its equivalent.

*Dissertation.* The candidate must submit a dissertation produced at West Virginia University under the direction of a major professor which demonstrates a high order of independent scholarship, originality, competence in research, and an original contribution to the field of specialization.

*Final Examination.* If the candidate's dissertation is approved and he has fulfilled all other requirements, he will be admitted to the final oral examination before his doctoral committee. At the option of his committee, a written examination may also be required. The final examinations(s) shall be concerned with the dissertation, its contribution to knowledge, and the candidate's grasp of his field of specialization and its relation to other fields.

*Time Limitation.* Requirements for the degree of Doctor of Philosophy must be completed within seven years.

### **The Degree of Doctor of Musical Arts in: Performance and Literature; Composition**

*Admission.* Applicants to the program leading to the degree of Doctor of Musical Arts must present necessary credentials for evaluation of previous training and experience to the Graduate Department of the Division of Music. For performance this includes copies of programs of recent major recitals, a transcript of all grades, and must show proof that the applicant has had a minimum of 28 semester hours in liberal arts studies. The applicant must also be approved for the program by an Audition Committee, by giving evidence of superior performance, artistic maturity, and extensive repertoire as specified under Graduate Applied Music Requirements. The Audition Committee shall



consist of the Director of the Division of Music, the Chairman of the Applied Music Department, and the major professors involved with the degree. For composition the applicant must also be approved for the program by an Evaluation Committee on the basis of scores presented of his works, accompanied by recordings if possible, which will show a successful handling of various forms and media and indicate the capacity to attain professional standing in his field. To be admitted to the program the applicant must have attained an average grade of B in courses taken for his Master's degree.

*Candidacy.* Graduate students meeting the requirements of the Division of Music and the general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are:

1. Demonstrate minimal acquaintance with German and French by the completion of German 2 and French 2 (or their equivalents) with a grade of "C" or better. (Students may petition to substitute Italian or Spanish for French.)

2. Pass written examinations satisfactorily to show:

- a. Broad knowledge in Theory and Music History and Literature.
- b. Knowledge in depth in the literature of the field of specialization (performance only).

3. Pass satisfactorily a comprehensive oral examination covering the entire field of music.

4. Present a public recital (performance only).

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. Should the applicant fail the written examinations he may apply to take them again after a minimum period of three months. Should the applicant fail the comprehensive oral examination he may be examined again after a minimum period of six months. The results of the second oral examination will be considered final.

*Fields of Specialization.* The degree of Doctor of Musical Arts is offered in the area of Performance and Literature in the fields of Specialization of (1) Piano, (2) Voice, and (3) Organ; and in (4) Composition.

*Curriculum.* The exact amount and nature of course work to be undertaken by a candidate will be determined by the adviser with the approval of the Doctoral Committee in the light of the candidate's previous preparation and his field of specialization.

*Residence.* In general, the requirements for the degree of Doctor of Musical Arts contemplate at least three years of full-time graduate work. A minimum of 36 weeks is required in residence in full-time graduate study at West Virginia University beyond the Master's degree or its equivalent.

*Recitals, Performance, and Research (performance only).* Recital, performance, and research requirements should be the equivalent to approximately 20 credit hours. A prospectus indicating the various performances and/or projects to be presented for the satisfaction of these requirements will be drawn up by the candidate with the help of his major professor, and submitted to his doctoral committee for approval. (Approximate credit-hour equivalents to be

established by the candidate's committee are: solo recital, 3-5; written research project, 3-5; major opera role, 2-4; lecture recital, chamber music program, concerto, major oratorio role, 2.) This prospectus should display a variety of kinds of music and types of presentations appropriate for the preparation of an artist-teacher, and may include solo recitals, lecture recitals, chamber music programs, concerto performances, major roles in opera or oratorio, or written research projects. It would include two solo recitals and normally will include either a research project or at least one lecture recital.

*Compositions and Research (composition only).* Composition and research requirements should be the *equivalent* to approximately 20 credit hours. "Equivalent credit" will be assigned by the student's doctoral committee on the basis of four to seven credits for a major work (symphony, opera, etc.) and fewer credits for lesser works. Credits may be assigned both on a qualitative and a quantitative basis. Proposed works will be approved by the Committee to insure that sufficient variety and breadth of compositional experience is included. Normally, at least one major work will be required. Credits of 2 to 4 hours will be included for a written paper such as an analysis of a twentieth century composition.

*Final Examination.* If the candidate's compositions, project (if any), and recitals are approved and he has fulfilled all other requirements, he will be admitted to the final oral examination before his Doctoral Committee. At the option of his Committee, a written examination may also be required. The final examination(s) shall be concerned with the compositions, the project (if any), and the candidate's grasp of his field of specialization and its relation to other fields.

*Time Limitation.* Requirements for the degree of Doctor of Musical Arts must be completed within seven years.

## **The Degree of Doctor of Education**

The degree of Doctor of Education is offered in cooperation with the College of Human Resources and Education. The sequence of prerequisites to admission, prerequisites to candidacy, and requirements for the degree are set out in the Education section of this bulletin. The requirements for the degree of Doctor of Education for students in music are identical with those for students in education, except that, for students in music, a maximum of 24 semester hours of graduate work pursued in fulfillment of the requirements for the Master's degree or its equivalent, if of suitable character and quality, may be credited toward the doctorate.

### **Music**

#### **Applied Music**

218. **Repertoire. I.** 0-2 hr.

219. **Repertoire. II.** 0-2 hr.

400. **Applied Music. I, II.** 1-4 hr. Open to qualified students in any field in Applied Music. Course number may be repeated as many times as necessary or desirable. A student must demonstrate ability of grade-level 4 on an instrument to receive credit in Music 300 on that instrument. Students other than music majors may take a maximum of one 30-minute lesson per week at one hour credit.

409. **Master Class in Applied Repertoire. I, II, 2 hr. PR: Consent.** A master class designed to give coverage through performance of the literature of a specific Applied Music field. Course may be repeated for credit.

#### Conducting

410. **Conducting. I. 3 hr. PR: Music 52 or equiv.** A graduate course in instrumental and choral conducting. Major works are prepared and conducted through the use of recordings and the large University music organizations.
411. **Conducting. II. 3 hr. PR: Music 410.**

#### Literature

230. **Music of Africa. I, II. 3 hr.** A survey of the traditional music of selected areas of Africa south of the Sahara with particular reference to East Africa. Study of the diverse musical cultures with emphasis on the historical background, instruments, ensembles, forms, and styles, and the music in its social context.
231. **History of Music. I. 3 hr.** Survey of music history from the pre-Christian era to the baroque.
232. **History of Music. II. 3 hr.** Survey of music history from the baroque to the contemporary period.
330. **Survey of Vocal Music. I. 3 hr. PR: Music 33-34 or equiv. and consent.** A survey of masses, oratorios, cantatas, and operas from the late Renaissance to the twentieth century. Solo repertoire will not be included.
331. **Survey of Instrumental Music. II. 3 hr. PR: Music 33-34 or equiv. and consent.** A survey of instrumental ensemble music, chamber music, concertos, symphonies and other orchestral music from the late Renaissance to the twentieth century. Solo repertoire will not be included.
332. **Studies in Contemporary Music. I. 3 hr. PR: Music 34 or equiv. and consent.**
333. **Survey of Chamber Music. 3 hr. PR: Music 34.**
334. **Collegium Musicum. I, II. 1-2 hr.** Performance of outstanding musical works not in the standard repertory. Although open as a performance group to upperclassmen, graduate students will select appropriate vocal and instrumental music, investigate modes of performance, prepare any necessary editions, and direct rehearsals under supervision. May be repeated for credit.
423. **Keyboard Literature. S. 3 hr. PR: Music 218, 219.** An intensive study of the literature for keyboard instruments and the history of the literature.
424. **Song Literature. S. 3 hr. PR: Music 218, 219.** An intensive study of the Art Song and the Lied and the history of their development.
425. **Choral Literature. 3 hr. PR: Music 218, 219.** An intensive study of the body of choral music and the history of its development.
430. **Introduction to Musical Bibliography. I. 2 hr. PR: Music 33, 34 or equiv.** A survey of musical bibliography with appropriate research assignments.
431. **Introduction to Musical Bibliography. II. 2 hr. PR: Music 430.** Continuation of Music 430 with emphasis on the individual student's field of specialization and more detailed research problems.
432. **Music in the Middle Ages. I. 3 hr. PR: Music 33, 34 or equiv. and consent.** A detailed study of the music and musical practice from the beginning of the Christian era to 1400.
433. **Music in the Renaissance. II. 3 hr. PR: Music 33, 34 or equiv. and consent.** Continuation of Music 432 through the sixteenth century.



436. **Music in the Baroque Period. I.** 3 hr. PR: Music 33, 34 or equiv. and consent. A detailed study of the music and musical practice of the period from 1600 to 1750.
437. **Music in the Classic and Romantic Periods. II.** 3 hr. PR: Music 33, 34 or equiv. and consent. Continuation of Music 436 covering the period from 1750 to 1900.
438. **History of Notation. S.** 3 hr. PR: Music 33, 34 or equiv. A detailed study in transcribing the musical manuscripts of the Middle Ages.
439. **History of Notation. S.** 3 hr. PR: Music 33, 43 or equiv. Continuation of Music 438 covering the Renaissance Period.

#### Church Music

429. **Survey of Sacred Music. S.** 4 hr. PR: Music 33, 34 or equiv. A study of music suitable to the liturgical year, including the historical background of the Jewish, Catholic, and Protestant liturgies.

#### Music Education

340. **Band, Orchestra, Choral, Opera Theatre, and Music Education Clinics.** 1-2 hr. Special problems of organization and development of the various performing organizations. Lecture, laboratory and discussion groups.
341. **Music in the Elementary School. I, II.** 3 hr. PR: Music 30, 41, 42 or consent. Development of skills, procedures, techniques, and materials used by the general classroom teacher of music in grades 1-8. Not open to music majors.
342. **The Teaching of Music Appreciation.** 3 hr. PR: Music 30, 41, 42 or equiv. A review of information, materials, sources, and techniques involved in teaching appreciation of music in the public schools. Not open to music majors.
343. **Contemporary Techniques in Classroom Music.** 3 hr. PR: Music 30, 41, 42 or equiv. Intensive study of the principles and practice of contemporary techniques in elementary and junior high school classroom music, including those of Orff and Kodaly.
346. **Music in the Junior High School.** 2 hr. PR: Music 151, 152 or equiv. A consideration of the potentialities and special needs of the junior high school in music education; programs, procedures, and materials.
440. **Choral Techniques. II.** 2 hr. PR: Music 151, 152 or equiv. A study of advanced techniques and procedures involved in the development of ensembles.
442. **Instrumental Techniques. I.** 2 hr. PR: Music 151, 152 or equiv. A study of advanced techniques and procedures involved in individual performance and instruction through lecture-demonstrations by the applied music faculty.
444. **Music Education. II.** 3 hr. PR: Music 151, 152 or equiv. Survey and critical study of the total music education program.
445. **The Supervision of Music.** 2 hr. PR: Music 151, 152 or equiv. Problems in the supervision of music in the elementary grades and in junior high school.
446. **Introduction to Research in Music Education. I.** 3 hr. PR: Music 151, 152 or equiv. A study of various subjects and techniques of values in research in music education.
448. **Psychology of Music Learning. II.** 3 hr. The application of learning theory to music learning; the nature of musical talent; music talent testing.
449. **Psychology of Music. I.** 3 hr. An introductory study of musical acoustics and psychology of perception of music.
451. **Music in Society.** 2 hr. PR: Music 33, 34 or consent. The function throughout history of music in society; the relation between social factors and musical practice.

452. **Aesthetics of Music.** II. 2 hr. PR: Music 33, 34 or consent. An examination of the main classical and contemporary aesthetic theories and their applications to music.

#### Opera

419. **Opera Theatre.** I, II. 0-4 hr. PR: Music 19 or consent. Continuation of Music 19. Performance of major roles and advanced production techniques. Qualified students will undertake production-direction projects under supervision.

#### Theory and Composition

260. **Upper Division Composition.** 2 hr. PR: Four semesters Music 160, or consent based on scores submitted. Creative writing with emphasis on practical composition for performance. May be repeated for credit.
263. **Counterpoint.** I. 2 hr. PR: Music 68 or consent. Sixteenth century counterpoint.
264. **Counterpoint.** II. 2 hr. PR: Music 68 or consent. Eighteenth century counterpoint.
265. **Analysis of Musical Form.** I. 3 hr. PR: Music 68 or consent. A detailed study of the structure of music.
266. **Major Project in Theory, Composition, or Music History.** 2 hr. PR: Music 68.
299. **Recital.** I, II. 0-2 hr. Not available for graduate credit. To be used to fulfill applied major graduation requirement only when the student has achieved grade level 9. Students who have reached grade level 6 may receive 1 hour credit, which may not be used to fulfill graduation recital requirement.
377. **Computer Applications in Music.** I. 3 hr. Computer programming and a survey of computer applications in music.
380. **Remedial Theory.** I, II. 0 hr. A course for graduate students who are deficient in undergraduate theory requirements.
460. **Composition.** I, II. 3 hr. PR: Consent. A course primarily for candidates for the graduate degrees in Theory or Composition. Course may be repeated for credit.
467. **Analytical Techniques.** I. 3 hr. A study of various theories of musical analysis and their application.
470. **Orchestration.** I, II. 2 hr. PR: Music 172 or equiv. Major projects of orchestration. Course may be repeated for credit; maximum credit 6 hours.
472. **Band Arranging.** II. 2 hr. PR: Music 172 or equiv. Major projects in arranging for the concert band.
475. **Pedagogy of Theory.** II. 3 hr. PR: Music 68 and consent. Consideration of the various approaches to the teaching of theory.
481. **Nonserial Techniques of 20th Century Composition.** I. 2 hr. A theoretical and analytical course including the application of various techniques in student compositions.
482. **Serial Techniques.** II. 2 hr. A theoretical and analytical course including the application of serial techniques in student compositions.

#### Research or Recital

492. **Advanced Studies in Music.** I, II. 2-8 hr. PR: Consent of the instructor which in some cases may be contingent upon doctoral foreign language examinations. Primarily intended for Ph.D. candidates. Intensive individualized reading reported in group discussions. Course may be repeated as many times as necessary, in as many areas as needed, and several different sections (i.e. areas) may be pursued simultaneously.

493. **Recital.** 2 hr. For Music Education majors only.
494. **Doctoral Seminar.** I, II. 2 hr. PR: Consent. Intensive individual investigation and preparation of research papers. Course may be repeated for credit; maximum credit 8 hours. Presented by the combined doctoral staff in music.
495. **Dissertational Guidance.** I, II. 1-12 hr.
496. **Lecture Recital.** 2 hr. PR: Music 430.
497. **Research.** I, II. 1-15 hr.
498. **Recital.** 1-4 hr. PR: Music 299 (Senior Recital) or equiv.

## **Applied Music Requirements\***

### **Major Instrument**

**Applied Music Majors.** All entering graduate students majoring in Applied Music must demonstrate by audition grade-level 10 ability on their major instrument to be accepted for that area.

**Music Education, History of Music.** All entering graduate students majoring in these areas must demonstrate by audition grade-level 7 ability on their major instrument, and to be eligible for graduation must demonstrate grade-level 8 ability.

**Theory, Composition.** All entering graduate students majoring in these areas must demonstrate by audition grade-level 8 ability on their major instrument.

**Doctor of Philosophy.** All entering graduate students for the Ph.D. must demonstrate performance ability on the major instrument to the satisfaction of the Admissions Committee.

### **Piano**

**Music Education.** All entering graduate students in Music Education must demonstrate Piano ability to satisfy either grade-level 2 (for instrumentalists) or 3 (for vocalists).

**Theory, Composition.** All entering graduate students majoring in these areas must demonstrate Piano ability to satisfy grade-level 4.

**Applied Music, History of Music.** All entering graduate students majoring in these areas must demonstrate Piano ability to satisfy grade-level 3.

## **Courses in Applied Music**

See the Applied Music office of the Division of Music for a listing of applied music courses on the graduate level.

## **DIVISION OF ART**

Candidates for the Degree of Master of Arts in Art must have an undergraduate major or minor in art, a teaching field in art, or the equivalent. Before being admitted to candidacy for the degree the student may be asked to take a comprehensive examination in the field and a test designed to demonstrate his ability to do graduate work, and any deficiency in preparation must be made up without graduate credit.

\*Graduates of the Division of Music may enter on their past record of grade-level achievement without audition, unless an audition is deemed necessary by the Director of the Division of Music.



Divisional requirements for the degree are as follows:

1. Completion of a minimum of 30 semester hours of graduate work, including not more than 6 hours in thesis or thesis-project.
2. Completion of a thesis or thesis-project.
3. Passage of an oral examination on the thesis or thesis-project.

Of the 30 hours, not more than 18 may be in studio courses.

With the consent of his committee, the student may elect a maximum of 6 hours in a related subject.

## Art

211. **Figure Drawing.** I, II. 3 hr. PR: Art 11 or 12, and/or consent. Study of the construction of the figure. Drawing from the draped and partially draped model.
213. **Painting.** I. 3 hr. PR: Art 113 or consent.
214. **Painting.** II. 3 hr. PR: Art 213 or consent.
216. **Painting.** I. 3 hr. PR: Art 214 or consent.
217. **Painting.** II. 3 hr. PR: Art 216 or consent.
220. **Art and the Schools.** I. 2 hr. PR: 4 hr. of art, including a minimum of 2 hr. studio. The function of art in the curriculum at various grade levels and a study of standards of achievement.
230. **Printmaking.** I. 3 hr. PR: Art 133 or consent.
231. **Printmaking.** II. 3 hr. PR: Art 230 or consent.
250. **Renaissance Painting.** I. 3 hr. PR: Art 105, 106, or consent. A study of painting in Italy from 1400 to 1600.
260. **Modern Painting.** II. 3 hr. PR: Art 105, 106, or consent. Developments in painting from the French Revolution to the present day.
310. **Painting.** I, II. 3-9 hr. PR: 12 hr. of painting or consent. Independent studio work with interdisciplinary seminars.
320. **Printmaking.** I, II. 3-9 hr. PR: 12 hr. of printmaking or consent. Independent studio work with interdisciplinary seminars.
321. **Administration and Supervision of Art.** II. 2 hr. PR: Art 220 or consent. Mainly for administrators and school principals who wish to become informed about all programs and the philosophies underlying them.
325. **Secondary School Art.** II, S. 3 hr. Art 11, 12, 121, 122, 113, 114, or consent. Information and working skills desirable for the teaching of art on the secondary school level. Offered alternate years.
326. **Sculpture.** I, II. 3-9 hr. PR: 12 hr. of sculpture or consent. Independent studio work with interdisciplinary seminars.
390. **Study of Original Works of Art.** S. 6 hr. PR: Art 105, 106, or consent of the Division. Directed study of the museums and libraries of some urban center such as Washington or New York; a study of the architectural developments of the locality. Offered alternate summers.
451. **Special Topics.** I, II. 1-3 hr. per sem. (May be repeated for a maximum of 12 hr.). PR: Consent of the Division. Individual study to be determined by the student's requirements.
497. **Research.** I, II. 1-15 hr.

## **DIVISION OF DRAMA**

### **The Degree of Master of Arts**

Persons who possess a bachelor's degree from an accredited college or university may be admitted to the program. Any deficiencies in undergraduate preparation in upper-division courses in Drama appropriate to the anticipated area of specialization will be made up either without credit or (in instances of 200 or above numbered courses) added to the credit required for the degree.

1. Successful completion of the minimum number of required graduate hours as set forth in Program "A" or Program "B" below.
2. Completion, within the framework of the Graduate School and Division of Drama standards, of one of the two following programs of study:
  - A. Concentration program which meets the following requirements:
    - (1) Successful completion of at least a minimum of 30 semester hours of graduate credit. No more than 9 of the 30 credit hours will be in research and thesis.
    - (2) Successful passage of comprehensive written examination in the fields of study. Such examinations are administered toward the end of the student's course work and then only if and when the student has a "B" grade-point average or 75 per cent of his credit hours are of "B" grade or higher.
    - (3) Submission for approval by the student's graduate committee of a thesis demonstrating original research and scholarly reporting.
    - (4) Successful completion of an oral examination on the thesis.
  - B. General program which meets the following requirements:
    - (1) Similar to above program (A) with a total of 36 hours required. The six additional hours to be substituted for the thesis requirement and to be taken in drama or cognate fields upon the approval of the faculty adviser.
    - (2) Successful passage of comprehensive examinations, both written and oral, in all areas of Drama. Either a 3.0 (B) grade-point average or 75 per cent of "B" grades for the hours carried is prerequisite to taking comprehensive examinations.
3. The student pursuing Program A or Program B will emphasize either a directing or a design specialty, oriented toward a professional or teaching career in drama.

#### **Drama**

202. **Scene Design. II.** 3 hr. PR: Drama 100, 102, or consent. Lecture and laboratory in theories of scene design for stage and television, including actual construction of designs. Open to juniors, seniors, and graduate students.
203. **Advanced Theatre Lighting Design. II.** 3 hr. PR: Drama 103 or consent. Advanced theories of lighting and design for the stage. Course includes practical experience with advanced lighting equipment.

204. **Advanced Costume Design.** II. 3 hr. PR: Drama 104 or consent. Individual study in design styles and techniques. Survey of the position of costume design in theatre today.
250. **Advanced Problems in Interpretation.** II. 3 hr. PR: Drama 50 and consent. Designed to deal with individual problems of advanced students in interpretation.
251. **Professional Reading.** I, II. 3 hr. PR: Consent. Intensive training in interpretation. Designed to meet needs of individual. Full length public recital prepared and presented. Limited enrollment.
252. **Art of Storytelling.** S. 3 hr. PR: Consent. Principles involved in effective presentation of stories, with practical experience in classroom and before audiences. Stories of all types for adults and children studied.
260. **Theatre Performance and Rehearsal Laboratory.** I, II. 1 to 3 hr. PR: Drama 161 or consent. Participation in assigned theatre projects. Appreciation of creativity and performance techniques in theatre. Majors only. Maximum credit, 6 hr.
275. **Advanced Acting.** II. 3 hr. PR: Drama 75 and consent. Characterization, script analysis, style, theories, and techniques. Designed to meet needs of individual student.
276. **Actors Studio.** 1 hr. PR: Drama 76, 176, 275 or consent. Advanced laboratory experience in acting and production styles of historical and modern theatre through the use of staged scenes.
280. **Advanced Play Directing.** II. 3 hr. PR: Drama 180, or consent. Emphasis on work of directing as an integrating artist. Display of high level of proficiency in direction of a one-act play required of all students enrolled.
281. **Theatrical Dialects.** I. 3 hr. PR: Consent. Study and mastery of fifteen common dialects used in theater and radio.
282. **Creative Dramatics.** I. 3 hr. PR: Drama 75 or consent. The study and practice of creative dramatic activity as a method of learning and self development for children.
284. **Puppetry.** I. 3 hr. PR: Drama 75 or consent. A comprehensive survey of construction and manipulation techniques of puppets. Includes an evaluation of the role of puppetry in child behavior and therapy techniques.
285. **Advanced History of Theater.** II. 3 hr. Historical survey of theater from primitive time to present. Includes both oriental and occidental theaters.
286. **Drama Criticism and Aesthetics.** I. 3 hr. A survey of chief critical and aesthetic theories of drama-ancient, modern contemporary.
290. **Playwriting.** II. 3 hr. PR: Consent. Development of creative ability in dramatic composition. Study of techniques and problems of playwriting. Of cultural value, but primarily a writing course.
375. **Styles of Acting and Directing.** II. 3 hr. PR: Drama 180, Drama 175 or consent. Extensive and intensive study of directing and acting styles.
400. **Applied Creative Performance.** 3 hr. Creative projects and/or performance. Must have faculty approval as part of student's graduate program.
431. **Research Methods and Survey.** 3 hr. PR: Consent. Research methods and techniques and general survey of the field of drama.
444. **Survey of Educational Methods and Practices.** 3 hr. Survey and critical study of the total drama education program.
460. **Specialized Seminars.** 3-9 hr. PR: Consent. Selected fields of study in drama. (May be repeated for a maximum of 9 credit hours).
497. **Research.** I, II. 1-15 hr.



# College of Engineering and School of Mines

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## Requirements for Admission

A student desiring to take courses for graduate credit in the College of Engineering must first comply with the appropriate regulations of the Graduate School.

A student who intends to become a candidate for a degree must apply for admission through the Office of Admissions to the major department of his choice. Acceptance by the major department will depend upon review of the student's academic background and the available facilities in the department.

An applicant with a baccalaureate degree, or its equivalent, from a department accredited by the Engineers' Council for Professional Development will be admitted on the same basis as engineering graduates of West Virginia University. Lacking these qualifications, an applicant must first fulfill the requirements of the department in which he is seeking an advanced degree.

Admission to candidacy for a graduate degree is required prior to obtaining that degree. A graduate student may apply for admission to candidacy by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0, based on all graduate courses, taken in residence, for which he has received a grade at the time of application.

## Academic Standards and Curricula

No credits which are reported with a grade lower than C are acceptable toward an advanced degree.

To qualify for an advanced degree, the graduate student must have a grade-point average of at least 3.0 based on all courses acceptable for graduate credit for which he has received a grade from the University.

Each candidate for a degree must select his major subject in that department in which his degree is taken:

*Ph.D. Degree*—See departmental descriptions.

*M.S. Degree*—Each department has a designated M.S. degree and in addition the College has an undesignated degree, Master of Science in Engineering. For all M.S. degrees each candidate will, with the approval of his graduate committee, follow a planned program which must conform to one of the following outlines:

1. A minimum of 30 semester credit hours, not more than 6 of which are in research leading to an acceptable thesis.
2. A minimum of 33 semester credit hours, not more than 3 of which are in research leading to an acceptable problem report.
3. A minimum of 36 semester credit hours, with no thesis or problem report required.

At least one-half of the courses taken, exclusive of research, must be in the College of Engineering with as many as possible at the 300 level.

A graduate student in the College of Engineering must comply with the regulations of his major department.

## **Master of Science in Engineering**

This interdepartmental degree program is designed for students who desire to pursue work in areas other than that of their baccalaureate degree in engineering or science. Graduate students who wish to become candidates for this degree should register with the department in which the major portion of the work is to be done.

*Admission and Academic Standards.* Students must comply with the rules and regulations as outlined under Requirements for Admission and Academic Standards for graduate work in the College of Engineering.

*Adviser and Examining Committee.* Each student will be assigned an adviser and an advisory and examining committee will be appointed by the department in which the major portion of the work is to be done.

*Final Examination.* On completion of the course requirements a candidate for the degree of Master of Science in Engineering shall be required to pass a final examination which may be written, or oral, or both, covering both course material and the thesis or problem report, depending upon the option selected.

## **The Degree of Doctor of Philosophy**

*Admission.* Admission to the Graduate School of West Virginia University is required of all applicants for admission to a program of study and research leading to the Ph.D. Applicants for admission are expected to have successfully completed a Bachelor of Science or Master of Science degree program in some phase of engineering equivalent to the program leading to this degree in effect at West Virginia University. Admission to the Graduate School does not necessarily assure entrance into the College of Engineering Ph.D. program. Formal admission to the Ph.D. program is granted by the Graduate Programs Executive Committee after review of a student's petition which includes a record of his academic performance and a proposed program of study.

*Requirements for Candidacy.* After admission to the program and after a period of residence, the applicant will be admitted to a comprehensive preliminary or qualifying examination (either oral or written or both) in which he must demonstrate: (a) a grasp of the important phases and problems of the field of study in which he proposes to major and an appreciation of their relation to other fields of human knowledge and accomplishments; and (b) the ability to employ rationally the instruments of research developed in his major field. In addition, the student must satisfy the foreign language requirements of the Graduate School.

When an applicant has successfully passed his comprehensive examination he will be formally admitted to candidacy for the Doctor's degree. Admission to candidacy must precede the final examination for the Doctor's degree. Graduate courses pursued in fulfillment of the requirements for the Master's degree, if of suitable character and quality, may be credited toward the doctorate.

*Curriculum.* The degree of Doctor of Philosophy is not awarded for the mere accumulation of course credits nor for the completion of a definite residence requirement. The exact amount and nature of the course work to be undertaken by a candidate will be established for each individual candidate with the object of insuring a rational and coherent progression of academic development beyond the Bachelor of Science degree.

*Residence.* The requirements for the degree of Doctor of Philosophy contemplate approximately three years of full-time graduate work beyond the Bachelor's degree. A minimum of 36 weeks in residence in full-time graduate study or its equivalent at West Virginia University is required, and must include a minimum of two semesters at WVU.

*Dissertation.* The candidate must submit a dissertation on a topic within the area of his major interest. The dissertation must represent the results of independent research and must constitute a definite contribution to knowledge. It is anticipated that the work leading to the completion of the dissertation would require 24 hours in research and/or dissertation credits or satisfactory evidence of equivalent time devoted to research and preparation of the dissertation.

*Final Examination.* Upon completion and approval of the dissertation and fulfillment of all other requirements, the candidate shall pass a final examination conducted by a committee of at least five members recommended by the major department and appointed by the Dean of the Graduate School. The examination shall be primarily a defense of the dissertation although other questions necessary to establish the validity of the dissertation may be in order.

## **AEROSPACE ENGINEERING**

### **Master of Science in Aerospace Engineering**

Students must comply with rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

*Thesis.* Normally a thesis is required of all candidates for the degree of Master of Science in Aerospace Engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and in addition should conform to additional thesis requirements of the Department of Aerospace Engineering.

Whether or not a thesis is required shall be determined by the department and shall be recorded in the student's file as a part of his planned program.

*Final Examination.* Each candidate for the Master's degree shall pass a final examination administered by his Advisory and Examining Committee.

*Courses.* The following grouping of courses is given as a guide for selecting a graduate program leading to the degree of Master of Science in Aerospace Engineering:

Group I. Required of all candidates. Six semester credit hours of advanced mathematics beyond a first course in differential equations.

Group II. Major. Minimum of 9 semester hours of Aerospace Engineering courses, other than A.E. 497, in the 300 and 400 series.



In order to meet the minimum requirements for the degree of Master of Science in Aerospace Engineering, additional courses may be taken from the following, subject to the approval of the student's Advisory and Examining Committee:

1. Courses from Groups I and II.
2. Aerospace Engineering courses in the 200 series which are not required for the degree of Bachelor of Science in Aerospace Engineering of West Virginia University.
3. Physics and Chemistry courses in the 200 to 400 series.
4. Courses in other departments of the College of Engineering in the 200 to 400 series.

## **The Degree of Doctor of Philosophy**

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

Candidates for the Doctor of Philosophy degree, regardless of their specific major, may be required to attain a proficiency in each of the following areas: (1) fluid mechanics, (2) thermodynamics, and (3) applied mathematics.

The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the field of Aerospace Engineering. It must have good literary form and style, and must give a thorough survey of prior literature in the subject. The candidate is required to take a final oral examination upon completion of the dissertation in defense of his research.

## **Aerospace Engineering**

### **A.E.**

215. **Experimental Fluid Dynamics II.** 3 hr. PR: A.E. 115. Continuation of A.E. 115 with increased emphasis on dynamic measurements. Shock tube/tunnel and subsonic and supersonic measurements. Experiments include optical techniques, heat transfer to models, and viscous flow measurements. Error analysis of test data. 2 hr. lec., 3 hr. lab.
216. **Applied Aerodynamics.** 3 hr. PR: A.E. 140. Chordwise and spanwise airload distribution for plain wings, wings with aerodynamic and geometric twist, wings with deflected flaps, and wings with ailerons deflected. Section induced drag characteristics. 3 hr. lec.
220. **Guided Missile Systems.** 3 hr. PR: A.E. 112 and/or conc: A.E. 150. Design philosophy according to mission requirements. Preliminary configuration and design concepts. Aerodynamic effects on missiles during launch and flight. Ballistic missile trajectories. Stability determination by analog simulation. Performance determination by digital and analog simulation. Control, guidance, and propulsion systems. Operational and reliability considerations. 3 hr. lec.
235. **Fluid Dynamics IV.** 3 hr. PR: A.E. 112. One dimensional non steady gas-dynamics. Shock tube theory and applications. Fundamentals of supersonic and hypersonic flow and the determination of minimum drag bodies. 3 hr. lec.
242. **Flight Testing.** 3 hr. PR: A.E. 140. Applied flight test techniques and instrumentation, calibration methods, determination of static performance char-

- acteristics, and introduction to stability and control testing based on flight test of Cessna Super Skywagon airplane. Flight test data analysis and report preparation. 1 hr. lec., 6 hr. lab.
249. **Space Mechanics.** 3 hr. PR: Math. 18, T.A.M. 51. An introduction of flight in and beyond the earth's atmosphere by space vehicles. The laws of Kepler and Orbital theory. Energy requirements for satellite and interplanetary travel. Exit from and entry into an atmosphere. 3 hr. lec.
  250. **Advanced Topics in Propulsion.** 3 hr. PR: A.E. 150 or consent. Special problems of thermodynamics and dynamics of aircraft power plants. Chemical rocket propellents and combustion. Rocket thrust chambers and nozzle heat transfer. Nuclear rockets. Electrical rocket propulsion. 3 hr. lec.
  260. **Design of Flight Structures I.** 3 hr. PR: A.E. 161. Structural design and analysis of flight vehicle members. Layout and detail design of specified components are required. 1 hr. lec., 6 hr. lab.
  261. **Design of Flight Structures II.** 3 hr. PR: A.E. 161. Analysis and detail design of simple fittings, beams, welded structures, forgings, castings. Methods of production and fabrication. 1 hr. lec., 6 hr. lab.
  265. **Aeroelasticity.** 3 hr. PR: A.E. 160. The study of vibrating systems of single degree and multiple degrees of freedom, flutter theory and modes of vibration, torsional divergence and control reversal. 3 hr. lec.
  280. **Aerospace Problems.** 1-6 hr. Upper division and graduate.
  285. **Thesis.** 2-6 hr. PR: Senior standing and consent.
  291. **Introduction to Research.** 1-3 hr. PR: Senior standing and consent. An introduction to the methods of organizing theoretical and experimental research. Formulation of problems, project planning, and research proposal preparation.
  292. **Research Problems.** 2-6 hr. PR: A.E. 291 or consent. Performance of the research project as proposed in A.E. 291. Project results are given in written technical reports, with conclusions and recommendations.
  315. **Fluid Flow Measurements.** 3 hr. PR: A.E. 112 or consent. The principles and measurements of static and dynamic pressures and temperatures, velocity and Mach number forces. Optical techniques and photography. Design of experiments. Review of selected papers from the literature. 2 hr. lec., 3 hr. lab.
  380. **Special Problems.** 2-4 hr. PR: Consent of department chairman. A course for graduate students in the non-research program. The student will select a specialized field and follow a course of study in that field under the supervision of a counselor.
  411. **Dynamics of Viscous Fluids.** 3 hr. PR: Consent. Exact solutions of the Navier-Stokes equations. Laminar incompressible and compressible boundary layer theory, similarity solutions and integral methods. 3 hr. lec.
  412. **Fundamentals of Turbulent Flow.** 3 hr. PR: A.E. 411 or consent. Survey of the basic experimental data. Application of the semi-empirical theories to pipe, jet and boundary layer flow. Turbulent heat and mass transfer. Statistical theory of turbulence and recent applications. Hydrodynamic instability and its relation to transition. 3 hr. lec.
  413. **Dynamics of Real Gases.** 3 hr. PR: A.E. 411 or consent. Fundamentals of multicomponent, chemically reacting, gas flows; thermodynamic properties of equilibrium mixtures from statistical mechanics; chemical kinetics; effects of the chemical model on high-temperature, high-speed flow properties.
  425. **Perfect Fluid Theory.** 3 hr. PR: Consent. Conformal mapping including Schwarz-Christoffel transformations. Inviscid flows over airfoils, spheres, cones, wedges, and bodies of revolutions. 3 hr. lec.
  435. **Gas Dynamics I.** 3 hr. PR: A.E. 112 or consent. Nonsteady gas dynamics and shock tube theory. Applications of shock tubes in aerospace research. Com-

pressible flow theory in the subsonic, transonic, and supersonic regimes. 3 hr. lec.

- 440. **Advanced Flight Mechanics.** 3 hr. PR: A.E. 140, 112. Dynamic stability. Obtaining flight characteristics of the vehicle from dynamic flight test techniques, such as frequency response, and transient response methods. The problems of automatic control. 3 hr. lec.
- 449. **Space Mechanics.** 3 hr. PR: Math. 245, A.E. 112, 150. Variational formulation of mechanics. Theory of orbits and trajectories with applications to astronomical problems. Introduction to the space environment of the solar system. 3 hr. lec.
- 458. **Foundations of Magnetohydrodynamics I.** 3 hr. PR: Consent. Effects of ionization in gas flows; equations of state, charge, mass, momentum and energy conservation; effects of self-generated and external electric and magnetic fields on electrically conducting fluids and transport coefficients. 3 hr. lec.
- 459. **Applied Magnetohydrodynamics II.** 3 hr. PR: A.E. 458 or consent. Incompressible and viscous MHD channel flow; plane waves in fluids, discontinuities and MHD shock waves; applications of MHD to electric power generation, etc. 3 hr. lec.
- 465. **Advanced Aeroelasticity.** 3 hr. PR: A.E. 265. Deformation of structures under static and dynamic loads, flutter of straight and swept wings, disturbed motion of an elastic model, dynamic response in gusts and landings, the aeroelastic model theory. 3 hr. lec.
- 466. **Dynamic Loads.** 3 hr. PR: A.E. 203, 265. Dynamics of a particle, lift distribution during accelerated maneuvers, beam bending and torsion with unsteady loads, empennage loads during dynamic flight conditions, landing impact loads. 3 hr. lec.
- 474. **Materials and Theories of Failure.** 3 hr. PR: A.E. 161. Failures in simple stress states, combined stress states; method of fatigue failure, minimum weight structures, evaluation of material to resist design load conditions. 3 hr. lec.
- 475. **Advanced Flight Vehicle Structures.** 3 hr. PR: A.E. 161. Incomplete tension fields, critical loads, torsional column failure, instability of flat sheets, cylindrical structure, special methods of analysis. 3 hr. lec.
- 497. **Research.** 1-15 hr.

## **AGRICULTURAL ENGINEERING AND FOREST ENGINEERING**

### **Master of Science in Agricultural Engineering**

A. D. Longhouse, *Program Director*

Before being admitted to graduate work in the Department of Agricultural Engineering, the prospective student must be admitted to the Graduate School. Candidates for the M.S. in Agricultural Engineering degree must first satisfy the requirements of the B.S. in Agricultural Engineering degree or its equivalent from a recognized agricultural engineering department. In general, candidates must meet the requirements of the B.S. in Agricultural Engineering degree, but candidates who have an engineering degree other than the B.S. in Agricultural Engineering degree may choose the M.S. in Engineering degree and need not satisfy or remove the requirements for the B.S. in Agricultural Engineering degree.

*Thesis.* A thesis is required of all candidates for the M.S. in Agricultural Engineering degree or M.S. in Engineering degree. In most cases it will be



necessary to take 6 hours of research work, Agricultural Engineering 497. A thesis, however, is not automatically approved after the required number of semester hours of research work has been completed. The candidate may find that completion of the thesis for approval will delay his originally anticipated date of graduation. The major subject, including thesis, must be taken in the Department of Agricultural Engineering. Candidates may specialize in power and field machinery, soil and water conservation, farm structures, or electric power and processing. On satisfactory completion of his thesis and course work, the candidate will be given an examination by his special committee.

*Thesis Supervisor.* Each student will be assigned a thesis supervisor who will serve as chairman of his graduate committee.

## Agricultural Engineering

### Ag. Eng.

201. **Agricultural Structures.** II. 3 hr. PR: T.A.M. 52. Structural design and functional requirements of agricultural buildings. 2 hr. rec., 3 hr. lab.
210. **Electric Power.** II. 3 hr. PR: E.E. 105. Economic application of electric light, heat, and power. 2 hr. rec., 3 hr. lab.
220. **Agricultural Process Engineering.** II. 3 hr. PR: C.E. 115, M.E. 101. Application of the fundamentals of engineering to agricultural engineering processes. 2 hr. rec., 3 hr. lab.
230. **Farm Power.** I. 3 hr. PR: M.E. 101. Fundamental theories underlying design and operation of internal combustion engines used in agriculture. 2 hr. rec., 3 hr. lab.
240. **Hydrology.** I. 3 hr. PR: C.E. 115. Study of a hydrologic cycle with emphasis on precipitation and runoff as related to design of hydraulic structures, soil and water conservation, and flood control. 3 hr. rec.
250. **Soil and Water Conservation.** I. 3 hr. PR: C.E. 115. Engineering principles and practices in conservation, utilization, and management of soil and water resources. 2 hr. rec., 3 hr. lab.
260. **Properties of Biological and Animal Materials.** II. 3 hr. PR: Biol. 1, T.A.M. 102, or consent. Study of physical properties of biological materials as related to harvesting, handling and transporting, conditioning, preserving and storing operations. 2 hr. rec., 3 hr. lab.
290. **Elements of Machinery Design.** II. 3 hr. PR: M.E. 101. Design requirements for construction, principles of operation and adequate adjustment of agricultural machines and principles of testing agricultural equipment. 2 hr. rec., 3 hr. lab.
300. **Seminar.** I. 1 hr. PR: Senior or graduate standing.
340. **Problems in Hydrology.** I. 3 hr. PR: Ag. Eng. 240. Consideration of special problems in hydrograph analysis, hydrologic performance of small watersheds, erosion and sedimentation, hydro-meteorological studies, flood runoff and peak discharge, drought, river forecasting, frequency analysis of hydrologic data. Special report. 3 hr. rec.
341. **Physical Climatology.** II. 3 hr. PR: Consent. Physical principles underlying the variations and changes in climate, climatic controls, elements of micro climatology, engineering applications and uses of climatic data. 3 hr. rec.
- 420, 421. **Special Topics.** I, II, S. 1-6 hr. (For the Master's degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
497. **Research.** I, II, S. 1-15 hr.

## Forest Engineering

### Master of Science in Engineering

A. D. Longhouse, *Program Director*

*Admission.* Graduate studies in Forest Engineering may lead to the degree of Master of Science in Engineering. It is open to graduates of wood science, forest science, or accredited engineering curricula. Students with Bachelor of Science degrees in Forestry, Agriculture, Mathematics, or Physics are eligible, providing certain undergraduate requirements are satisfied.

Students must comply with the rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

A student is admitted to candidacy for the Master of Science in Engineering degree only by formal written application after he has completed at least 12 credit hours of graduate work at West Virginia University with a grade-point average of at least 3.0.

Candidates with no training in Forestry will be required to take courses in the Division of Forestry.

Candidates may elect one of three areas for specialization:

1. *Hydrology.* Course requirements include: Ag. Eng. 240, C.E. 221, 252, Geol. 261, 363, Statistics 211 and 212. Electives will be selected to take into account the student's background and interests.

2. *Power and Machinery.* Course requirements include: Statistics 211 and 212, Forest Eng. 391, 392. Electives will be selected to take into account the student's background and interests.

3. *Industrial.* Course requirements include: Statistics 211 and 212. Electives will be selected to take into account the student's background and interests.

*Thesis Supervisor.* Each student will be assigned a thesis supervisor who will serve as chairman of his thesis committee.

*Thesis.* A thesis is normally required of all candidates for the Master of Science in Engineering Degree. In most cases it will be necessary to take 6 hours of research, Forest Eng. 497. A thesis, however, is not automatically approved after the required number of semester hours of research work have been completed. The candidate may find that completion of the thesis for approval will delay his originally anticipated date of graduation. The major subject, including thesis, must be taken in Forest Engineering. Upon satisfactory completion of his thesis and course work, the candidate will be given an examination by his special committee.

## Forest Engineering

### Forest Eng.

- 300. **Seminar.** I or II. 1 hr. Current discussion of research in forest engineering and special report.
- 391. **Logging Systems Engineering.** I. 3 hr. PR: Math. 18 or consent. Theory and design of modern forest harvesting systems such as balloon logging, cableways, pipelines and conveyors. Design features of specialized forest harvesting machines and devices. Systems engineering approach to equipment utilization. 3 rec.

392. **Hydraulic Power. II.** 3 hr. PR: Math. 18 or consent. Includes characteristics of hydraulic control components, hydraulic fluid characteristics, materials in hydraulic circuits, components and elements for circuit design, the feedback control approach, derivation of component transfer functions, measuring control dynamic characteristics, computer simulation techniques, hydraulic control circuits and hydraulic design practice. 3 rec.
420. **Advanced Independent Study, I, II.** S. 1-6 hr. PR: Consent. Designed to increase the depth of study in a specialized area of forest engineering.
497. **Research. I, II.** S. 1-15 hr.

## **CHEMICAL ENGINEERING**

### **Master of Science in Chemical Engineering**

### **Master of Science in Engineering**

### **Master of Science in Nuclear Engineering**

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering. The three types of master's degree program, as outlined under College of Engineering curricula, are offered in all graduate programs administered by the Department of Chemical Engineering. A thesis is normally required of a candidate in the master's degree programs.

*Adviser and Examining Committee.* Each student will be assigned an adviser, and an advisory and examining committee.

*Courses.* The graduate committee for each student will be responsible for following the departmental guidelines in determining the specific courses appropriate to the program of a particular student.

*Examination.* A candidate shall be required to pass examinations which may be written, or oral, or both, covering both course material and the thesis or problem report, depending upon the program selected.

### **Master of Science in Chemical Engineering**

A. F. Galli, *Program Director*

Admission is restricted to those holding a baccalaureate degree in chemical engineering or equivalent.

*Practice Oriented Program.* The department also offers a unique 36-hour non-thesis program, for students desiring to terminate their formal education at the M.S. level. Candidates for the practice oriented program should show evidence of responsible industrial employment for two summers.

### **Master of Science in Engineering**

R. C. Bailie, *Program Director*

The M.S.E. program is available to students holding a baccalaureate degree in chemical engineering who wish to pursue a broad interdisciplinary program, and to students holding a baccalaureate degree in other fields of engineering or the physical sciences.



## **Nuclear Engineering**

G. L. Blackshaw, *Program Director*

The Department of Chemical Engineering offers a graduate program in Nuclear Engineering leading to the degrees of Master of Science in Engineering and Master of Science in Nuclear Engineering. Admission may be granted to those holding baccalaureate degrees in engineering, pure and applied physical science, or mathematics. Applicants must present entrance credits consisting of an acceptable background in mathematics and physical science including Modern Physics.

Areas of emphasis include reactor engineering, shielding analysis, process radiation, and the behavior of materials in nuclear radiation environments.

## **The Degree of Doctor of Philosophy**

C. Y. Wen, *Program Director*

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in general requirements for graduate work in the College of Engineering. A program with a major in Chemical Engineering, designed to meet the needs and objectives of each student, will be developed in consultation with the student's committee.

The research work for a doctoral dissertation should show a high order of originality on the part of the student and must offer an original contribution to the field of engineering science. It must have good literary form and style, and must give a thorough survey of the prior art with acceptable standards of documentation. Upon completion of the dissertation, the candidate will be required to submit to an oral defense. This examination will be designed to establish the candidate's logic, critical ability, and reasoning power, and will be based upon the field covered by the dissertation.

## **Chemical Engineering**

Ch.E.

- 210. **Process Engineering.** 3 hr. PR: Ch.E. 111. Process equipment calculations for unsteady state. Determination of maximum and minimum process conditions. Economics of processing methods. 3 hr. rec.
- 224. **Process Development.** 3 hr. PR: Chem. 134, 144, Ch.E. 111 and 143. Development of process systems from the modified unit operations-unit process concept. Use of thermodynamics and kinetics in the evaluation of system requirements and performance. 3 hr. rec.
- 231. **Mathematical Methods in Chemical Engineering.** 3 hr. PR: Math. 18. The classification and solution of mathematical problems important in chemical engineering. Vector analysis and matrix algebra. Functions of several variables. Analytical methods for ordinary and partial differential equations including orthogonal functions and integral transforms. 3 hr. rec.
- 280. **Chemical Engineering Problems.** 1-6 hr. For juniors, seniors, and graduate students. May be used to correct deficiencies preparatory to or following courses such as Ch.E. 170 and 171 or for students in other disciplines desiring to take only a portion of a course.
- 307. **Advanced Distillation.** 2-5 hr. PR: Math. 18 and consent. Advanced study of vaporization principles of separation of liquid mixtures, steam, batch, continuous, azeotropic, extractive, and molecular distillation. 3 hr. rec., 0-6 hr. lab.

- 310, 311. **Advanced Chemical Engineering Laboratory.** 2-4 hr. each PR: Consent. Design, construction, operation and supervision of specialized equipment for obtaining engineering data. Design of engineering experiments, data processing and reporting including evaluation of performance.
- 323, 324. **Advanced Process Development.** 3 hr. PR: Consent. Use of extended and generalized unit process and unit operation concepts; specialized synthetic methods; reaction mechanisms and their effects on equipment design and performance; study of properties, their evaluation, prediction and marketability; industrial toxicology and plant safety. 3 hr. rec.
330. **Process Dynamics and Control.** 3 hr. PR: Consent. Dynamic response of processes and control instruments. Use of Laplace transforms and frequency response methods in analysis of control systems. Application of control systems in chemical reactors, distillation, and heat transfer operations. Introduction to non-linear systems. 3 hr. rec.
344. **Thermodynamics.** 3 hr. PR: Consent. Emphasis is placed on the logical development of thermodynamic principles. These are applied to selected topics including development and application of the phase rule, physical and chemical equilibria in complex systems and non-ideal solutions. Introduction to non-equilibrium thermodynamics. 3 hr. rec.
345. **Chemical Reaction Engineering.** 3 hr. PR: Consent. Homogeneous reactions, batch and flow reactors, ideal reactors, macro and micro mixing, non-ideal flow reactors, heterogeneous reaction systems, catalytic and non-catalytic reactions, reactor stability analysis, reactor optimization. 3 hr. rec.
- 372, 373. **Advanced Chemical Engineering Design.** 3 hr. each PR: Consent. Critical analysis and evaluation of equipment design procedures. Advanced aspects of plant layout with particular emphasis upon the systems approach. 3 hr. rec.
400. **Chemical Engineering Seminar.** 1-6 hr. Includes such topics as fluidization, bioengineering, transport phenomena for biological systems, air and water pollution abatement, fast-reaction kinetics, radiation and direct energy conversion. Other topics may be included consistent with demand and changing requirements.
402. **Advanced Fluid Dynamics.** 3 hr. PR: Consent. An analysis of the flow of fluids and the transport of momentum and mechanical energy. The differential equations of fluid flow; potential flow, flow in porous media, laminar boundary layer theory, and non-Newtonian fluids. 3 hr. rec.
404. **Advanced Heat Transfer.** 3 hr. PR: Consent. Theory of the transport of thermal energy in solids and fluids as well as radiative transfer. Steady and transient conduction, heat transfer to flowing fluids, evaporation, boiling, and condensation, packed and fluid bed heat transfer, macroscopic balances. 3 hr. rec.
406. **Advanced Mass Transfer.** 3 hr. PR: Consent. Theory of diffusion, interphase mass transfer theory, turbulent transport, simultaneous mass and heat transfer, mass transfer with chemical reaction, high mass transfer rates, multicomponent macroscopic balances. 3 hr. rec.
480. **Advanced Independent Study.** 1-6 hr. PR: Consent. Designed to increase the depth of study in a specialized area of chemical engineering.
497. **Research.** 1-15 hr.

## **Nuclear Engineering**

### **Nuc.E.**

290. **Introductory Nuclear Engineering.** 3 hr. PR: Physics 12. Includes elementary nuclear physics necessary for understanding nuclear engineering. Design and operation of nuclear reactors, shielding, instrumentation, health physics, fuel cycles, uses of radioactive isotopes, nuclear propulsion. 3 hr. rec.

390. **Analysis of Nuclear Energy Systems.** 3 hr. PR or conc: Physics 225 or equiv., and Physics 287 or equiv. Probability concepts and nuclear cross sections. Multiplication constant and neutron flux. Diffusion theory. Homogeneous reactors: one group theory; multigroup theory. Heterogeneous reactors. Reflected reactors. Reactor kinetics. Control rod theory. Special considerations in analysis of heterogeneous systems. 3 hr. rec.
391. **Principles of Nuclear Reactor Engineering.** 3 hr. PR: Nuc.E. 390. Thermal analysis of reactor systems. Shielding. Fuel element design. Reactor poisons. Instrumentation. Economics of nuclear systems. Radiation, protection. Legal aspects. Radioactive waste disposal. 3 hr. rec.
392. **Interaction of Radiation and Matter.** 3 hr. PR or conc: Physics 225. Radiation damage models, effects of nuclear radiations on reactor components and other materials, experimental techniques. Industrial applications: process control, polymerization, sterilization, pasteurization. 3 hr. rec.
393. **Nuclear Laboratory.** 1-6 hr. PR or conc: Nuc.E. 390 or equiv. Techniques of radiation measurements. Determination of neutron properties; diffusion length, albedo, etc. Exponential reactor parameters. Reactor simulation. Experiments with swimming pool reactor and cobalt-60 radiation facility. Dosimetry, 1 hr. rec., 6 hr. lab.
400. **Nuclear Engineering Seminar.** 1-6 hr. PR: Consent. Includes such topics as the kinetics of boiling water reactors, breeder reactor concepts, fast reactor systems, pulsed reactor systems, radiation chemistry, and space nuclear power systems. Other topics may be included consistent with demand and changing requirements.
480. **Advanced Independent Study.** 1-3 hr. Special studies in fuel reprocessing, shielding, reactor technology, and related areas.
497. **Research.** 1-15. hr.

## CIVIL ENGINEERING

### Master of Science in Civil Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

*Courses.* No rigid curriculum is prescribed for the degree of Master of Science in Civil Engineering. Graduate level work in mathematics and mechanics is customary and at least 15 hours should be selected from graduate civil engineering courses.

*Thesis.* A thesis is normally required of candidates for the M.S.C.E. degree. A maximum of 6 semester hours credit in research (C.E. 496) is usually devoted to thesis preparation. However, the thesis is not automatically approved after the required number of semester hours of research work have been completed. The thesis must conform with the general requirements of the Graduate School and with any additional requirements established by the Department of Civil Engineering.

At the discretion of the student's advisory committee a non-thesis program may be established in which either a comprehensive problem or additional course work is substituted for the thesis.

*Final Examination.* The candidate for the M.S.C.E. degree shall be given an oral or written examination by his advisory and examining committee. The examination shall cover all course material and the thesis, if one is required.



Students approved for the graduate program who do not possess the B.S.C.E. degree may arrange a program leading to the Master of Science in Engineering, the details of which are described elsewhere in this catalog.

## **The Degree of Doctor of Philosophy**

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in general requirements for graduate work in the College of Engineering. A program designed to meet the needs and objectives of each student will be developed in consultation with the student's committee.

The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the art and science of civil engineering. The dissertation must have good literary form and style and must present a thorough review of the prior study in the subject with acceptable standards of documentation. The candidate is required to take a final oral examination upon completion of the dissertation. This examination is designed to permit the candidate to demonstrate his ability to present and defend his work orally in a logical manner.

### **Civil Engineering**

#### **C.E.**

- 212. **Concrete and Aggregates.** 3 hr. PR: C.E. 110. Considerations and methods for the design of concrete mixes. Effect of air entraining agents and other additives. Studies of the influence of aggregate properties on the design and performance of concrete mixtures. An analysis of the methods of test commonly used for concrete and aggregates and the significance of these tests. 2 hr. rec., 3 hr. lab.
- 213. **Construction Methods.** 3 hr. PR: C.E. 110 and 180. The study of construction methods, equipment, and administration with particular emphasis on the influence of new developments in technology. 2 hr. rec., 3 hr. lab.
- 222. **Open Channel Flow.** 3 hr. PR: C.E. 120. An analysis of the hydraulic problems associated with natural waterways, man-made waterways, and the design of the hydraulic structures of open channels. 3 hr. rec.
- 232. **Principles of Transportation Engineering.** 3 hr. PR: C.E. 131 or consent. A basic approach to the problem of integrated transportation systems from the standpoint of assembly, haul, and distribution means. Analysis of the characteristics of the transport equipment and traveled way. Power requirements, speed, stopping, capacity, costs, economics of location and route selection will be discussed. Future technological developments and innovations will be considered. 3 hr. rec.
- 235. **Railway Engineering.** 3 hr. PR: C.E. 101. Development and importance of the railroad industry. Principles of location, construction, operation, and maintenance. 3 hr. rec.
- 251. **Public Health Engineering.** 3 hr. PR: C.E. 146 or 147 or consent. The engineering aspects involved in the control of the environment for the protection of the health and the promotion of the comfort of man. Discussions will include communicable disease control, milk and food sanitation, air pollution, refuse disposal, industrial hygiene, and radiological health hazards. 3 hr. rec.
- 252. **Water Resources Engineering.** 3 hr. PR: C.E. 120. The design of water-resource systems. The interrelationship between economic objectives, engineering analysis, and governmental agencies. 3 hr. rec.

260. **Structural Analysis II.** 3 hr. PR: C.E. 160. An introduction to the fundamental theory of statically indeterminate structures. General theory of continuity and iterative and energy methods applied to the analysis of indeterminate beams and frames. 3 hr. rec.
270. **Structural Design I.** 3 hr. PR or conc: C.E. 260. Theory and design of reinforced concrete members. Design considerations for concrete bridges and buildings. 2 hr. rec., 3 hr. lab.
271. **Structural Design II.** 3 hr. PR or conc: C.E. 260. Design of steel bridge and building structures. Welded, riveted, and bolted connections; simple and moment-resistant connections; cost estimates. 2 hr. rec., 3 hr. lab.
281. **Foundations Engineering.** 3 hr. PR: C.E. 180. Soils exploration and the design and analysis of engineering foundations. Particular emphasis on earth pressures and the design of retaining walls, studies of bracing systems and the elements of shallow and deep foundations for bridges and buildings. Movement of water through soil structures and control of water in excavations. 3 hr. rec.
291. **Comprehensive Projects for Civil Engineering.** 3 hr. PR: Senior standing or consent. The application of civil engineering principles, through group studies, to develop a solution for a comprehensive engineering problem. Consideration will be given to a problem involving all aspects of civil engineering. 2 hr. rec., 3 hr. lab.
307. **Photogrammetry.** 3 hr. PR: C.E. 101. Geometry and interpretation of the aerial photograph; flight planning; radial-line control; principles of stereoscopy; plotting instruments. 2 hr. rec., 3 hr. lab.
308. **Geodesy.** 3 hr. PR: C.E. 101. Precise base line measurements, triangulation and leveling, geodetic astronomy; figure of the earth, map projections; rectangular coordinate systems; least squares adjustments; gravity. 3 hr. rec.
310. **Bituminous Materials and Mixtures.** 3 hr. PR: C.E. 131. Manufacture and testing of bituminous materials. Significance of tests and specifications of bituminous materials. Principles of the design of bituminous mixtures, including methods of test and the influence of aggregate, temperature, and other variables upon design for stability and durability. Production of bituminous mixtures and construction practice in utilizing these mixtures. 2 hr. rec., 3 hr. lab.
311. **Pavement Design.** 3 hr. PR: C.E. 131, 180. Effects of traffic, soil, and loads on the design of pavement. Consideration of drainage and climate. Design of bases and sub-bases. Methods of design of flexible and rigid pavements. Performance of pavement surveys. 2 hr. rec., 3 hr. lab.
332. **Airport Planning and Design.** 3 hr. PR: C.E. 131 or consent. Airport financing, air travel demand modeling, aircraft trends, air traffic control, site selection, ground access, noise control, geometric design, pavement design, and terminal facilities. 3 hr. rec.
333. **Geometric Design of Highways.** 3 hr. PR: Consent. The theory and practice of the geometric design of modern highways. Horizontal and vertical alignment, cross-slope, design speed, sight distances, interchanges, and intersections are discussed. Critical analysis of design specifications. 2 hr. rec., 3 hr. lab.
334. **Introduction to Traffic Engineering.** 3 hr. PR: C.E. 131. This course will provide instruction in the purpose, scope, and methods of traffic engineering. Emphasis will be placed upon the three basic elements of the transportation system, i.e. the human, the vehicle, and the roadway. The characteristics of each element and interactions between the elements will be studied. The laboratory will be devoted to conducting simple traffic studies, solving practical problems, and designing traffic facilities. 2 hr. rec., 3 hr. lab.
345. **Properties of Air Pollutants.** 3 hr. PR: Consent. Physical, chemical, biological, and social behavioral properties of dusts, droplets, and gases in the atmosphere.

Air pollutant sampling and analysis. The planning and operation of air pollution surveys. 2 hr. rec., 3 hr. lab.

350. **Sanitary Chemistry and Biology.** 3 hr. PR: C.E. 147 or consent. Study of the physical and chemical properties of water. Theory and methods of chemical analysis of water, sewage, and industrial wastes. Biological aspects of stream pollution problems. 2 hr. rec., 3 hr. lab.
356. **Principles of Biological Waste Treatment.** 3 hr. PR: C.E. 350 or consent. Examination of biological systems used in waste treatment as to ecology and function. Models used to describe system behavior are developed. Laboratory experiments are performed to understand operation and design of treatment plants. 2 hr. rec., 3 hr. lab.
359. **Basic Radiological Health.** 3 hr. PR: Consent. Fundamental theory and terminology. Environmental and occupational hazards in the nuclear field. Radioactive waste disposal. Laboratory measurements of radio activity. 2 hr. rec., 3 hr. lab.
361. **Statically Indeterminate Structures.** 3 hr. PR: C.E. 260. Advanced topics in indeterminate structural analysis for trusses and nonprismatic members. 3 hr. rec.
363. **Introduction to Structural Dynamics.** 3 hr. PR: Math. 113 and C.E. 361 or 460. General theory for dynamic response of systems having one or several degrees of freedom. Emphasis on the application of dynamic response theory to structural design. 3 hr. rec.
372. **Plastic Design of Steel Structures.** 3 hr. PR: C.E. 260, 271 or consent. The fundamental concepts of the plasticity of steel. Analysis of structures for ultimate load. The influence of axial forces, shear forces, and local buckling on the plastic moment. Study of structural connections and deflections. Steel structure design. 3 hr. rec.
373. **Prestressed Concrete.** 3 hr. PR: C.E. 270. The analysis and design of determinate and indeterminate prestressed beams and frames. 3 hr. rec.
374. **Timber Design.** 3 hr. PR: C.E. 160 and Wood Sci. 261. Emphasis on the fundamentals of modern timber design and analysis. Topics to be presented include a review of wood properties, the design of beams, columns, arches, trusses, and pole structures using dimensional lumber, glue-laminated and plywood components. Detailed study of connections using nails, shear connectors, and adhesives. 3 hr. rec.
375. **Reinforced Concrete.** 3 hr. PR: C.E. 160, 270. Theory and design of slabs, beams, columns, footings, retaining walls, and concrete buildings, with emphasis on ultimate load design. 2 hr. rec., 3 hr. lab.
380. **Soil Properties and Behavior.** 3 hr. PR: Consent. A study of soil mineralogy and the physico-chemical properties of soils and their application to an understanding of the behavior of soils. Included is a detailed review of the basic and classical theories of permeability, consolidation, shear strength, and compaction. The prediction of the engineering behavior of soils is viewed in light of physico-chemical concepts. 3 hr. rec.
381. **Soil Testing.** 3 hr. PR: C.E. 180 or consent. Designed to complement and expand the material covered in C.E. 380 from an experimental standpoint. Experimental studies will be conducted to demonstrate empirical and theoretical principles. Emphasis will be placed on the proper interpretation of experimental results and the application of such results to practical problems. 1 hr. rec., 6 hr. lab.
421. **Hydraulic Structures.** 3 hr. PR: C.E. 120 or consent. The hydraulic analysis and design of engineering structures such as reservoirs, dams, spillways, gates, and outlet works. The study of hydraulic machinery, irrigation, hydroelectric power, drainage and flood control. 3 hr. rec.



422. **Surface and Subsurface Drainage.** 3 hr. PR: Consent. The study of the nature and requirements of drainage studies and drainage design as they pertain to transportation facilities. Emphasis is on the theory of drainage design and a critical analysis of drainage practices. 3 hr. rec.
430. **Highway Laws.** 3 hr. PR: Consent. The analysis of existing highway laws with emphasis on those aspects particularly related to planning functions such as reservation of right-of-way, access control, eminent domain, systems classification, and the basis for the existence and operation of various planning agencies. 3 hr. rec.
431. **Traffic Flow Theory.** 3 hr. PR: I.E. 213 and C.E. 438 or consent. An introduction to the basic concepts of quantitative analysis of traffic systems. Topics include probability theory, queuing theory, pedestrian and traffic delay at traffic signals, turning at intersections, parking problems, merging traffic on two lane roads, simulation of traffic problems. 3 hr. rec. (Also listed as I.E. 431.)
432. **Highway Economics and Administration.** 3 hr. PR: Consent. Study of the methods of financing highways, including federal participation. Consideration of the means of establishing allocation of highway cost and determination of economic justification of routes. Analysis of highway administrative organizations. 3 hr. rec.
434. **Urban Problems.** 3 hr. PR: Consent. The study of the particular problems of transportation in the urban area as they relate to the general development of the city. Emphasis is on the role of the engineer in the planning for urban transportation and the relationship of the engineer to the city planner and to the city administration. 3 hr. rec.
436. **Highway Planning I.** 3 hr. PR: Consent. Analysis of planning programs and methods including highway needs studies, priority rating systems, and programming methods. Consideration of traffic assignment and forecasting techniques. Devoted primarily to rural route problems. Case history method of study utilized. 3 hr. rec.
437. **Highway Planning II.** 3 hr. PR: C.E. 436. Continuation of C.E. 436 with special attention to urban locations and planning. 3 hr. rec.
438. **Traffic Engineering Characteristics.** 3 hr. PR: C.E. 131 or consent. The analysis of the basic characteristics of drivers, vehicles, and roadway that affect the performance of road systems. Studies of volumes, speeds, delays, intersections, interchanges, capacity, and accidents will be considered. The techniques of traffic engineering measurements, investigations, and data analysis, including laboratory practice, will be included. 2 hr. rec., 3 hr. lab.
439. **Traffic Engineering Operations.** 3 hr. PR: C.E. 438. The theory and practice of the application of traffic engineering regulations, traffic flow theory, the design and use of traffic control devices and signal systems. Traffic administration and parking control will be discussed. 3 hr. lec.
446. **Air Pollution Control Engineering.** 3 hr. PR: C.E. 345 or consent. Study of the engineering alternatives in achieving various degrees of air pollution control. Factors that are considered in selection and specification of dust and gas collectors and convertors for various types of operations, and the use of alternate process methods and process materials. 2 hr. rec., 3 hr. lab.
447. **Air Pollution Control Standards.** 3 hr. PR: C.E. 446 or consent. Comparative study of technical, economical, and social factors used in developing and establishing air pollution standards, criteria, and control limitations. Relationships between process design specifications, pollutant emission limitations, ambient air pollution effects on people and objects, air quality standards and emission performance limitations. 2 hr. rec., 3 hr. lab.
448. **Air Pollution Control Programs.** 3 hr. PR: C.E. 446 or consent. Examination of air pollution control programs of industries and government. Rationales

and patterns of organization structure and operating administrative factors, including intra-office and inter-office and other group relationships. Significance of relationship with planning fire prevention, water pollution control, building inspection, and economic development agencies. 3 hr. rec.

449. **Solid Waste Disposal.** 3 hr. PR: Consent. Study of traditional patterns and problems of solid waste storage, transport, and disposal. Examination of various engineering alternatives with appropriate consideration for air pollution control, water pollution control, and land reclamation. Analytical approaches to recovery and reuse of materials. 2 hr. rec., 3 hr. lab.
452. **Water Treatment Theory.** 3 hr. PR: C.E. 350. Theory of the various procedures and techniques utilized in the treatment of water for municipal and industrial use. Review of water quality criteria. Design of water purification facilities. 2 hr. rec., 3 hr. lab.
454. **Industrial and Advanced Waste Treatment.** 3 hr. PR or conc: C.E. 350 or consent. An introduction to the basic physical and chemical operations used in industrial and advanced waste treatment; applications for wastewater reclamation and reuse; study of industrial wastes from the standpoint of process, source, and treatment. 3 hr. rec.
455. **Municipal and Industrial Design of Solid Wastes Disposal Operations.** 3 hr. PR: C.E. 454 or consent. Study of design criteria of existing methods and equipment for the disposal of solid wastes generated by industry and municipalities: on site preparation; volume and density modification; and reclamation of marketable materials. Process, source, treatment, and final disposal with considerations of waste reclamation and reuse of available energy. 3 hr. rec.
457. **Hydraulics of Sanitary Engineering Works.** 3 hr. PR: C.E. 120. The application of the techniques of population growth estimation, rainfall and runoff analysis, food flow, and ground water data to the design of sanitary works. Design of water distribution systems and sewerage systems. 2 hr. rec., 3 hr. lab.
458. **Design of Sanitary Works.** 3 hr. PR: C.E. 120. The investigation of water supply and waste water disposal problems. The design of waste water treatment facilities. 2 hr. rec., 3 hr. lab.
460. **Statically Indeterminate Structures.** 3 hr. PR: C.E. 260 or consent. General theory of continuity, iterative, and classical methods of analysis of skeletal structures with emphasis on the influence coefficient method. 3 hr. rec.
461. **Bridge Engineering.** 3 hr. PR: C.E. 460. Statically indeterminate trusses; continuous trusses; steel and concrete arches; long-span and suspension bridges; secondary stresses. 3 hr. rec.
462. **Numerical Methods of Structural Analysis.** 3 hr. PR: C.E. 361 or 460. Methods of successive approximations and numerical procedures for the solution of structural problems. Application of these procedures to the analysis of bridges and builders. 3 hr. rec.
471. **Light Gage Metal Design.** 3 hr. PR: C.E. 260, C.E. 271, or consent. Analysis and design of light gage metal systems; flexural and compression member design; investigations into post buckling strength and optimum weight systems. 3 hr. rec.
473. **Structural Design for Dynamic Loads.** 3 hr. PR: C.E. 363 or consent. Nature of dynamic loading caused by earthquakes and nuclear weapon blasts; nature of dynamic resistance of structural elements and structural systems; criteria for the design of blast-resistant structures; criteria for the design of earthquake-resistant structures; simplified and approximate design methods. 3 hr. rec.
474. **Behavior and Advanced Design of Timber Structures.** 3 hr. PR: C.E. 260, C.E. 374, Wood Sci. 261 or consent. A study of the behavior and analysis of structural systems and components fabricated from timber. Topics include the



- behavior of timber members subjected to bending, shear, and compression, impact, and vibration. An evaluation of the time dependent characteristics of timber members under load. The analysis and design of special timber structures including lamella roofs, stressed skin and prestressed members, and space frames. 3 hr. rec.
475. **Analysis and Design of Multistory Structures.** 3-6 hr. PR: C.E. 270. Theories of action of beams, slabs, and columns of reinforced concrete; review of standard codes and specifications and their influence on design. 3 hr. rec.
476. **Behavior of Reinforced Concrete Members.** 3 hr. PR: C.E. 270 or consent. Studies of the actual behavior and strength of reinforced concrete members by critically reviewing experimental and analytical investigations. Beams subjected to pure flexure; columns subjected to axial compression; combined flexure and compression; combined flexure, shear, and bond. 3 hr. rec.
477. **Behavior of Reinforced Concrete Structure.** 3 hr. PR: C.E. 476. Continuation of C.E. 476. Studies of behavior and strength of statically indeterminate reinforced concrete structures. Comparison with reinforced concrete codes and specifications. 3 hr. rec.
478. **Thin Shell Roof Structures I.** 3 hr. PR: Math. 113, C.E. 361 or consent. Emphasis on the development and solution of the fundamental elastic equations for barrel vault roofs using matrix algebra. Study of the effects of edge members upon the strength and stiffness of barrel vault roofs. Design of simple shell structures. 3 hr. rec.
479. **Thin Shell Roof Structures II.** 3 hr. PR: C.E. 478 or consent. A continuation of C.E. 478. Analysis of multiple cylindrical shells using the theory of elasticity and matrix algebra. Ultimate load and variational methods in shell analysis. Design and analysis of doubly curved shells. 3 hr. rec.
480. **Geotechnic.** 3 hr. PR: Consent. A presentation of a unified approach to the various aspects of soil formation and the influence of the formative factors on the nature of soils and their use as engineering materials. Presented cooperatively with the Department of Agronomy and the Department of Geology. 3 hr. rec.
482. **Foundations Engineering.** 3 hr. PR: C.E. 380 or consent. Application of the principles of theoretical soil mechanics to the design of shallow and deep foundations. Detailed attention is given to methods of sub-surface exploration, spread footings and mats, pile foundations, retaining walls, sheet pile structures and braced cofferdams. Particular emphasis is given to economy and performance in the selection of foundation treatment. 3 hr. rec.
483. **Earthwork Design.** 3 hr. PR: C.E. 380 or consent. Application of the principles of theoretical soil mechanics to the design of embankments of earth and rock. Detailed attention is given to compaction methods and equipment, the stability of natural and man-made slopes, embankment foundation stability and the design of earth and rockfill dams. 3 hr. rec.
484. **Groundwater and Seepage.** 3 hr. PR: Consent. The flow of ground-water through soils and its application to the design of highways and dams and to construction operations. Particular emphasis is placed on the analytical solution of seepage problems. The classical flow net techniques for solving seepage problems are also given detailed consideration. 3 hr. rec.
485. **Airphoto Interpretation.** 3 hr. PR: Graduate standing. A study of airphoto interpretation techniques to obtain qualitative information concerning the extent, type, and engineering characteristics of surficial materials. Emphasis will be placed on the use of airphoto interpretation for the location of construction materials and the evaluation of engineering problems associated with the different materials that are encountered in the design and location of engineering facilities.



486. **Soil Dynamics.** 3 hr. PR: C.E. 380 and consent. The fundamental behavior of soils subjected to dynamic loads produced by explosion effects, earthquake effects, and foundation vibrations. Particular emphasis is placed on the stress-strain-time behavior of soils for conditions of rapid stress or strain change. Consideration is given to wave propagation resulting from ground motions. The theories of vibration of a mass resting on an elastic half-space are applied to foundations vibration problems. 3 hr. rec.
490. **Advanced Design Problems.** 2-6 hr. A design or investigation of any assigned problem related to civil engineering.
495. **Seminar.** 1-2 hr. PR: Consent. Studies and group discussion of structural, fluid mechanics, surveying, transportation, soil mechanics and foundations, and sanitary problems.
497. **Research.** 1-15 hr.

## ELECTRICAL ENGINEERING

### Master of Science in Electrical Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

*Thesis.* Normally a thesis is required of all candidates for the degree of Master of Science in Electrical Engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and in addition should conform to additional thesis requirements of the department.

Whether or not a thesis is required shall be determined by the department and shall be recorded in the student's file as a part of his planned program.

*Final Examination.* Each candidate for the Master's degree shall pass a final examination administered by his Advisory and Examining Committee. This examination may be written or oral or both and shall cover the course material. If a thesis is required, the examination shall also cover the thesis.

*Courses.* The following grouping of courses is a guide for selecting a graduate program leading to the degree of Master of Science in Electrical Engineering.

Group I. <i>Required of all candidates</i>	<i>Hr.</i>
E.E. 300. Seminar (Audit) .....	0
E.E. 325. Advanced Linear Circuit Analysis .....	3

Group II. *Major (Minimum of 9 hours of engineering courses in the 300 or 400 series other than Group I)*

Group III. *Minor (6 hours)*

Approved courses in Mathematics, or one of the Physical or Engineering Sciences

In order to meet the minimum requirements for the degree of Master of Science in Electrical Engineering additional courses may be taken from the following, subject to the approval of the student's Advisory and Examining Committee:

1. Courses in the 200 series which are not required for the degree of Bachelor of Science in Electrical Engineering at West Virginia University.
2. West Virginia University courses in the 300 or 400 series.

Students with a B.S.E.E. degree from other institutions may be required to take some electrical engineering courses in the 200 series as prerequisites for graduate courses. If these courses are normally required for the B.S.E.E. at West Virginia University, they will not be accepted for credit in a Master's degree program without approval of the student's Advisory and Examining Committee.

## **The Degree of Doctor of Philosophy**

A candidate for the degree of Doctor of Philosophy must comply with all requirements of the Graduate School and with the rules and regulations as outlined in "A Guide to the Graduate Program in Engineering" for graduate work in the College of Engineering. A program designed to meet the needs and objectives of each student will be developed in consultation with the student's committee. In addition, the following will be required by the department:

1. In general, requirements for the M.S.E.E. degree must be fulfilled. These requirements are outlined above.
2. Candidates for the Ph.D. degree who have been admitted with an M.S. degree from other institutions must satisfy the departmental course requirements for the M.S.E.E. degree.
3. A Ph.D. degree candidate will normally be required to take a minimum of six hours in his minor field. A minimum of three of these hours must be at the 300-400 level.

## **Electrical Engineering**

### **E.E.**

200. **Seminar.** (Credit). PR: Senior standing. Special material and projects.
201. **Electronics for Scientists.** 3 hr. PR: General Physics and Calculus or consent. A special course for chemists, physicists, medical researchers and other research workers having a limited background in electronics. The material covered will begin with electrical and electronic fundamentals and leads systematically into servomechanisms, operational amplifiers, digital circuits, and other devices used in current laboratory research and control problems. (Not open to Engineering students.) 1 hr. rec., 6 hr. lab.
216. **Fundamentals of Control Systems.** 3 hr. PR: E.E. 127. Fundamental analysis of the servomechanisms and automatic control devices. 3 hr. rec.
218. **Engineering Analysis and Design.** 3 hr. PR: E.E. 132, 153. Formulation and application of the method of engineering analysis based upon fundamental physical laws, mathematics, and practical engineering considerations. Emphasis is placed on the professional approach to the analysis of engineering problems. 3 hr. rec.
228. **Networks and Filters.** 3 hr. PR: E.E. 127 or consent. Analysis and synthesis of networks and filters. 3 hr. rec.
230. **Symmetrical Components.** 3 hr. PR: E.E. 141 or consent. Analysis of poly-phase systems in unbalanced and transient conditions. 3 hr. rec.

231. **Electrical Power Systems.** 3 hr. PR: E.E. 141 or consent. Analysis of balanced polphase systems, including transmission lines. Polyphase transformation. Principles of grounding and protection from lightning. 3 hr. rec.
234. **Electric Power Transmission and Distribution.** 3 hr. PR: E.E. 141. Circle diagrams applied to the various problems of power transmission; phase modifier applications and an introduction to power stability. 3 hr. rec.
235. **Electrical Machinery I.** 3 hr. PR: E.E. 132 or consent. Synchronous machines, windings, calculation of emf and mmf; mmf space functions. Potier diagram, ASA regulation, 2-reactance diagrams. Multiple-winding transformers and auto transformers. 2 hr. rec., 3 hr. lab.
236. **Electrical Machinery II.** 3 hr. PR: E.E. 133 or consent. Commutation theory of machines, d-c and a-c multiple-winding and special purpose machines; multiple machine systems. 2 hr. rec., 3 hr. lab.
244. **Introduction to Antennas and Radiating Systems.** 3 hr. PR: Consent. Point sources; arrays; thin linear antennas; miscellaneous radiation configurations; large radiating surfaces; antenna impedances. 3 hr. rec.
245. **Microwave Circuits and Devices.** 3 hr. PR: E.E. 141 or equiv. UHF transmission line theory; impedance matching; impedance charts; slotted lines; waveguide circuits elements; microwave energy sources. 2 hr. rec., 3 hr. lab.
252. **Electronics III.** 3 hr. PR: E.E. 153. Analysis of demodulation systems, wave-shaping circuits, electronic power-handling systems, photo-sensitive devices, and microwave devices. 2 hr. rec., 3 hr. lab.
253. **Physical Electronics I.** 3 hr. PR: E.E. 152. A study of the physical principles of electrical conduction and the application of these principles to electronic conduction in solids, electron emission, and conduction in vacuum and gas. 3 hr. rec.
257. **Transistor Circuits.** 3 hr. PR: E.E. 153 or consent. Application of the basic principles of semiconductor electronics to junction and field-effect devices. Development of equivalent circuits for junction diodes, transistors and field-effect transistors. 3 hr. rec.
264. **Introduction to Communications Systems.** 3 hr. PR: E.E. 153 or consent. Communications systems, or systems used to transmit information. The underlying principles of modern information transmission systems are stressed. Emphasis is placed upon the fundamental role of system bandwidth and noise in limiting the transmission of information. 3 hr. rec.
271. **Theory of Digital Computers.** 3 hr. PR: Senior and graduate students in Engineering, Mathematics, Physics, or Statistics. An introduction to the field of digital computer design. Topics include general computer organization, number systems and number representations, Boolean algebra and its application to computer design, and the characteristics of the major parts of a computing system. 3 hr. rec.
275. **Pulse Techniques.** 3 hr. PR: E.E. 127, 152. An introduction to the response of electrical networks to non-sinusoidal inputs, the analysis of active networks with large signals and the circuits and techniques used in pulse and digital equipment. Students will use the University's computing facilities by solving problems using ECAP. No previous programming is needed. 3 hr. rec.
278. **Analogue Computers.** 3 hr. PR: Math. 18. A study of the theory and operation of analogue computers. Amplitude scaling and time scaling on the analogue computer and application of the analogue computer to the solution of differential equations. 3 hr. rec.
280. **Electrical Problems I.** 1-3 hr. For junior, senior, and graduate students.
312. **Feedback System Theory.** 3 hr. PR: E.E. 216, 325. Signal flow graphs; sensitivity; return difference; mathematical definition of feedback; effects of feedback; multiple loop systems; multivariate systems. 3 hr. rec.



315. **State Variable Analysis of Systems.** 3 hr. PR: Consent. Matrix theory and linear transformations as applied to linear control systems. The state-space on time-domain study of stability, controllability, observability, etc. 3 hr. rec.
316. **Synthesis of Feedback Systems I.** 3 hr. PR: E.E. 312, 364. Methods of direct synthesis and optimization of feedback systems; Wiener theory; Pontryagin's maximum principle; dynamic programming; adaptive feedback systems. 3 hr. rec.
325. **Advanced Linear Circuit Analysis.** 3 hr. PR: Consent. Systematic formulation of circuit equations. The use of operational techniques to find total solutions. Applications and characteristics of the Laplace and Fourier Transforms, Matrix algebra, complex variable theory and state variables are made to circuit analysis and elementary circuit synthesis. 3 hr. rec.
328. **Modern Network Synthesis.** 3 hr. PR: E.E. 325. Study of the basic methods of modern network synthesis using passive devices. Develops the concept of a positive-real function and applies this and complex variable theory to network synthesis. 3 hr. rec.
330. **Electrical Machinery III.** 3 hr. PR: E.E. 235 or consent. Advanced theory of synchronous and induction machinery following Parks-Doherty-Nickel theory; applications of matrix algebra and tensor analysis. 3 hr. rec.
331. **Electrical Power Systems.** 3 hr. PR: E.E. 231 or consent. Transient and steady-state stability of systems. Traveling waves on transmission lines; lightning and switching surges. The principles of the application of analog and digital computers to solution of power system problems. 3 hr. rec.
340. **Advanced Electric and Magnetic Field Theory.** 3 hr. PR: Consent. Solutions of Laplace's equation as applied to static fields; the application of Maxwell's equations to guided wave and antenna problems. 3 hr. rec.
341. **Theory of Guided Waves.** 3 hr. PR: E.E. 340. Transverse electromagnetic waves; propagation in cylindrical waveguides; in homogeneously filled waveguides; waveguide discontinuities. 3 hr. rec.
350. **Electronic Circuits.** 3 hr. PR: E.E. 252. An advanced study for the analysis and design of electronic circuits; low-pass and band-pass amplifiers, single-tuned and double-tuned stages, equal ripple and maximally flat responses. 3 hr. rec.
353. **Physical Electronics II.** 3 hr. PR: E.E. 253, 257 or consent. Application of the principles of physics to semiconducting materials, junctions between semiconductors and metals, and semiconductor junctions. The development of equivalent circuits for semiconducting devices. 3 hr. rec.
364. **Communication Theory.** 3 hr. PR: E.E. 264 or consent. Detailed study of probability theory and its use in describing random variables and stochastic processes. Emphasis is placed on applications to problems in communication system design. 3 hr. rec.
366. **Information Theory I.** 3 hr. PR: E.E. 364. Probability concepts; theory of discrete systems; encoding; theory of continuous systems; systems with memory; the fundamental theorem of information theory. 3 hr. rec.
370. **Switching Circuit Theory I.** 3 hr. PR: E.E. 271 or equiv. This course presumes an understanding of the elements of a Boolean or switching algebra. This is a study of both combinational and sequential switching circuits with emphasis on sequential networks. Advanced manual design and computer-aided-design techniques for single and multiple output combinational circuits are covered initially. Then the analysis and design of sequential circuits are considered. Finally, the detection and prevention of undesired transient outputs are studied. 3 hr. rec.
373. **Design of Computer Arithmetic Circuits I.** 3 hr. PR: E.E. 271 or equiv. A detailed study of computer circuitry usable in performing binary arithmetic. This

course deals with the logic, circuitry, and engineering aspects of digital computer equipment design. Primary emphasis is placed on the design of high speed, parallel arithmetic units using the natural binary number system. Analysis of systems for representing negative numbers. A study of various means for obtaining high speed addition, subtraction, and multiplication. 3 hr. rec.

- 374. **Design of Computer Arithmetic Circuits II.** 3 hr. PR: E.E. 373. A continuation of the study begun in E.E. 373. High speed binary division, floating point arithmetic, modular or residue arithmetic, and techniques for checking arithmetic are covered. Recent innovations are studied as literature becomes available. 3 hr. rec.
- 380. **Electrical Problems II.** 1-6 hr. For graduate students.
- 390. **Advanced Independent Study.** 1-6 hr. PR: Consent. Individual investigation in advanced electrical engineering subjects that are not covered in formal courses.
- 400. **Seminar.** 1-3 hr. PR: Consent. Each graduate student will give an oral description of his written research proposal soon after beginning his thesis research. This will typically be a 30-minute presentation before the faculty and graduate students.
- 411. **Nonlinear Control System Analysis.** 3 hr. PR: Consent. The application of Liapunov's and Popov's methods to nonlinear control systems, together with classical techniques. 3 hr. rec.
- 413. **Sample-Data Control Systems.** 3 hr. PR: E.E. 312 or consent. A study of control systems in which the activating signal is represented by samples at regular time intervals. 3 hr. rec.
- 416. **Synthesis of Feedback Systems II.** 3 hr. Continuation of E.E. 316. 3 hr. rec.
- 466. **Information Theory II.** 3 hr. Continuation of E.E. 366. 3 hr. rec.
- 471. **Switching Circuit Theory II.** 3 hr. PR: E.E. 370, Math. 236, or equiv. Switching circuit theory is used to model the operations of networks of logic gates and flip-flops. Networks of this type are one form of discrete parameter systems. This course studies the use of the linear sequential machine as a means of modelling the general class of discrete parameter information systems. A system approach and the techniques of abstract algebra are used throughout. 3 hr. rec.
- 497. **Research.** 1-15 hr.

## **INDUSTRIAL ENGINEERING**

### **Master of Science in Industrial Engineering**

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

The M.S.I.E. degree program is designed to serve the graduate needs of a person holding a B.S.I.E. degree or an Industrial Engineering option in another field of engineering. Also, a person holding a degree in another field of engineering but who is willing to essentially fulfill the requirements of a B.S.I.E. degree may elect to pursue the M.S.I.E. degree. A review of the aims and objectives of each individual will permit exact evaluation of the courses required.

There are seven core areas of study available:

Core I—Transportation Science

Core II—Operations Research and Statistical Analysis

Core III—Computer Applications

- Core IV—Human Factors Engineering
- Core V—Systems Analysis
- Core VI—Manufacturing Processes
- Core VII—General Industrial Engineering

*Courses.* No rigid curriculum is set up for the M.S.I.E. or M.S.E. degrees. At least half of the 30 hours required for either degree must be in courses in the Department of Industrial Engineering; this is exclusive of research. At least 12 hours must be courses included in the particular core area chosen. (Exception: In Core Area VII, at least half of the 30 hours must be in the 300-400 number series.) A minor may be selected in another core area, in another branch of engineering, in mathematics, or in the College of Commerce.

*Thesis.* A thesis is usually required of all candidates for either degree and in practically all cases it will be necessary to take all of the six hours of research work (I.E. 497). A thesis, however, is not automatically approved after the required number of semester hours of research work has been completed. The thesis must be presented in a form that conforms to the general requirements of the Graduate School, and in addition must conform to the additional thesis requirements of the department.

*Thesis Supervisor.* Each student will be assigned to a thesis supervisor who will normally serve as chairman of his Examining and Advisory Committee.

*Final Examination.* On completion of his thesis and course work, the candidate will be given an oral examination by his Examining and Advisory Committee; additional examiners may be called in for this examination.

## Industrial Engineering

### I.E.

201. **Metal-Cutting Theory and Practice.** 3 hr. PR: I.E. 100 and Mat.E. 105. Metal-cutting tools, tool materials, work materials, cutting fluids, process of chip formation, cutting forces, tool-life tests, economics of tool life, measurement of product. 2 hr. rec., 3 hr. lab.
202. **Metal Forming Manufacturing Processes.** 3 hr. PR: I.E. 100 or consent. Applications and operations of the basic metal forming processes including the primary metal working processes and the metal shearing, drawing, binding, and squeezing processes, along with the machine tools required for these processes. 3 hr. rec.
203. **Metal Forming Theory.** 3 hr. PR: I.E. 202. The mechanics and basics of metal forming with elementary theoretical and descriptive investigations of tube-sinking, deep-drawing, wire-drawing, extrusion, cold rolling, and forging. 3 hr. rec.
204. **Metal Casting Manufacturing Processes.** 3 hr. PR: I.E. 100 and Mat.E. 105 or consent. Fluidity processes used in industry covering non-permanent processes such as sand molding, centrifugal molding, investment molding, and shell molding. Some permanent mold methods will be investigated along with metal processes, molding machines, and fundamentals of costing design. 3 hr. rec.
205. **Tool Design.** 3 hr. PR: I.E. 100. Design, construction, application, and economic aspects of jigs, fixtures, and special tools used in manufacturing on a production basis. 2 hr. rec., 3 hr. lab.
213. **Engineering Statistics.** 3 hr. PR or conc: Math. 17, I.E. 281 or consent. The use of graphical analysis; measures of central tendency and dispersion; normal, binomial, and Poisson distributions in engineering applications; linear regres-



- sion and correlation; tests of significance, nonparametric statistics, and analysis of variance. Includes applications of statistical sampling techniques in quality control. 3 hr. rec.
214. **Advanced Analysis of Engineering Data.** 3 hr. PR: I.E. 213. The application of advanced theories of statistical techniques to analyze and interpret industrial problems. Subjects include multiple regression, curvilinear regression, advanced analysis of variance, randomized complete blocks, Latin Square designs, factorial designs, transformations, and analysis of response curves. Accent is on proper design of experiments, proper interpretation of results, and thorough consideration of all errors of estimation and errors of inference. 3 hr. rec.
215. **Statistical Decision Making.** 3 hr. PR or conc: I.E. 213 or consent. Basic concepts of probability theory, discrete and continuous distributions, joint and derived distributions, expectation, and properties of estimators. Special emphasis on the applications of probability theory in operations research, quality control, and human factors engineering. 3 hr. rec.
216. **Industrial Statistics.** 2 hr. PR: I.E. 213. Economic objectives of quality control in manufacturing through sampling methods; the Shewhart control chart for variables, attributes, and defects per unit; statistical approach to acceptance procedures. 2 hr. rec.
220. **Theory of Industrial Engineering and Organization.** 3 hr. PR: Graduate standing and consent. History and development of scientific management in industry with early works of Taylor, Galbreth, and Gantt, to the present time. 3 hr. rec.
222. **Job Evaluation and Wage Incentives.** 3 hr. PR: I.E. 140 or consent. Principles used in evaluating jobs, rates of pay, characteristics and objectives of wage incentive plans; incentive formulae and curves. 3 hr. rec.
241. **Methods Analysis.** 2 hr. PR: I.E. 140 or consent. An advanced study of the techniques of methods analysis as an effective means of methods improvement and cost reduction. 2 hr. rec.
243. **Plant Layout and Design.** 3 hr. PR: I.E. 142. Problems in industrial plant design. Equipment location, space utilization, layout for operation and control, flow sheets, materials handling. Allied topics in power utilization, light, heat, and ventilation. 1 hr. rec., 6 hr. lab.
249. **Design of Dynamic Materials Systems.** 3 hr. PR: I.E. 140, I.E. 142 or consent. The application of Industrial Engineering theory and practice to the selection of material systems and equipment. This is to include the efficient handling of materials from the first movement of raw materials to the final movement of finished product. Present quantitative design techniques will be included. 3 hr. rec.
250. **Introduction to Operations Research.** 3 hr. PR: I.E. 213. A study of the basic tools and philosophies of operations research. Tools to be presented include: linear programming, queueing theory, inventory theory, and simulation. Other operations research techniques will be presented as they relate to the overall systems philosophy.
251. **Analytical Techniques of Operations Research.** 3 hr. PR: I.E. 213. A study of the analytical techniques used in operations research and industrial engineering with special emphasis on their application to industrial systems and operations. Optimizing techniques will be presented for a wide range of situations. Specific techniques to be covered include: differentiation of continuous functions, differencing of discrete functions, Lagrangian multipliers, and Kuhn-Tucker conditions. Other optimizing techniques to be presented include linear programming, quadratic programming, geometric programming, branch-and-bound methods, and search techniques.

259. **Introduction to Systems Engineering.** 1 hr. PR: I.E. 214, conc.: I.E. 250, I.E. 277. The nature of scientific methodology including: quantitative synthesis of models with accompanying objectives and restrictions, definition of terms, sampling and measurement of components of the model, development and testing of assumptions, optimizing techniques, testing and controlling the model and the solution, and error sensitivity of the model. Emphasis will also be toward development of the problem-solver's ability to successfully assign resources to the problem solution phases in a manner such as to equalize the marginal cost of improving the model's reliability. This course will provide an opportunity for the student to analyze an operation as it may interact with the whole system. 1 hr. rec.
260. **Human Factors Engineering.** 3 hr. PR: Consent. An examination of human factors engineering and man-machine systems to include a study of ambient environment, human capabilities and equipment design. Application of human factors engineering in workplace design, maintainability, and task design methodology. Study of system design for man-computer interface, life support requirements, simulators and man-machine systems. 2 hr. rec., 3 hr. lab.
270. **Standard Manufacturing Costs.** 3 hr. PR: I.E. 170. Development of standards for labor, material, and overhead expenses; uses of standards for control; analyses of variances between standard and actual costs. 3 hr. rec.
277. **Engineering Economy.** 3 hr. PR: Junior standing. Comparison of the relative economy of engineering alternatives; compound interest in relation to calculation of annual costs; present worth and prospective rates of return on investments; methods of depreciation; sunk costs, increment costs; general economy studies with emphasis on retirement and replacement of equipment; consideration of taxes, public works, and manufacturing costs as related to economic solution of engineering proposals. 3 hr. rec.
280. **Industrial Engineering Problems.** 1-3 hr. PR: Consent. Special problems relating to industrial engineering.
281. **Digital Computation for Engineers.** 3 hr. Conc: Math. 16. Study of processes of broadly integrating the digital computer into service for the engineer or scientist and study of the programming process with emphasis on coding with the automatic programming language Fortran. Considerable use will be made of the Computer Center equipment, especially the IBM 360 Model 75. Various other programming languages, such as COBOL, will be reviewed. Considerable time will also be devoted to topics such as real-time control, principles of computer functions, study of available equipment, board use categories of equipment, etc. 2 hr. rec., 3 hr. lab.
282. **Advanced Digital Computer Concepts.** 3 hr. PR: I.E. 181 or 281 or consent. Principles of digital computer functional components. Study of digital operating systems including structure of the various subsystem components such as monitors, input output control systems, and loaders. Advanced operating system concepts including multiprogramming, multiprocessing, teleprocessing, and time sharing will be covered. Various existing operating systems will be evaluated as well as principles in overall system design. 3 hr. rec.
283. **Information Retrieval.** 3 hr. PR: I.E. 181 or 281 or consent. Study of the tools, elements, and theories of information storage and retrieval. Areas of study include documentation, information framework; indexing; elements of usage, organization and equipment; parameters and implementation; theories of file organization and system design. 3 hr. rec.
284. **Simulation by Digital Methods.** 3 hr. PR: I.E. 213 or consent. An introduction to methods of simulation using the digital computer. Study of the methods of generating random numbers, the Monte Carlo technique, process generators, industrial dynamics models, methods of error analysis and reduction, and digital computer simulation languages such as Simscript, Dynamo and especially GPSS (General Purpose System Simulator-360). The student will be provided

the opportunity to use the digital computer to simulate moderately complex production, inventory, queueing, and maintenance systems. Although the primary emphasis is more practically restricted to models of industrial operations, the techniques are immediately adaptable to simulation of any physical or information system. Simulated experiments are also considered. 3 hr. rec.

285. **Electronic Computer Data Processing.** 3 hr. PR: Senior standing. Fundamentals of digital computer operations, equipment characteristics, input and output components. Elements of number systems. Fundamentals of "IR," information retrieval. Emphasis is placed on integrated systems analysis and design, business and industrial data for computer applications, and fundamentals of programming. Existing equipment systems and the economics of their applications will be reviewed.
300. **Advanced Manufacturing Processes.** 3 hr. PR: I.E. 100. A study of the newer and more complex manufacturing methods used in industry today. Welding and forming of titanium, magnesium, beryllium, and similar metals; assembly processes; powder metallurgy; adhesives and bonds; roll milling; electrical and chemical operations such as electro-forming and hot-dipping operations; hot forging; high energy rate forming (HERF); automated manufacturing processes including transfer mechanisms, continuous, and point-to-point numerical control; plastic tooling and fabrication methods; marking processes; and other manufacturing processes will be examined. 3 hr. rec.
301. **Advanced Metal-Cutting Theory and Practice.** 3 hr. PR: I.E. 201. The development of metal-cutting as a science through research, cutting-fluid theory, machinability of materials, tool materials, hot machining, tool-life tests, economics of machining. 2 hr. rec., 3 hr. lab.
309. **Automation in Industry.** 3 hr. PR: I.E. 100 or consent. The evolution, production fundamentals, and control systems of the principal fully automatic machine tools, both fixed and flexible, will be covered along with the basic philosophy, fundamentals, and methods of automation as practiced in industry today. 2 hr. rec., 3 hr. lab.
314. **Advanced Design of Industrial Experiments.** 3 hr. PR: I.E. 214. A study of several of the more complex statistical methods including sequential analysis, analysis of covariance, multiple range tests, transformation of data, orthogonal polynomials, large factorial experiments, confounding, fractional replication, split-plot designs, lattice designs with one and two restrictions on treatment allocation, with special emphasis on the power, relative efficiency, and interpretation of these designs.
316. **Advanced Industrial Statistics.** 3 hr. PR: I.E. 213. Advanced study of the economic application of statistics to quality control problems. Particular emphasis on developing models of quality control systems on the basis of statistical decision theory. Double and sequential sampling by attributes. Variables sampling plans. Advanced control chart methods. 3 hr. rec.
325. **Management Control.** 3 hr. PR: I.E. 170 or consent. A study of effective techniques for higher management control, including current concepts and controls applicable to production management problems.
340. **Advanced Time Study.** 3 hr. PR: I.E. 140. Review of the various investigations which have been made, with special consideration given to the development of these studies into new fields. 3 hr. rec.
341. **Methods Analysis and Work Simplification.** 3 hr. PR: I.E. 140, 277. An advanced study of the techniques of methods analysis, including modern means of methods research. Development of appropriate cost analyses to accompany improved operating plans. A study of the design, installation, and administration of work simplification programs, suggestion systems, and remuneration policies, and the means of intra-plant communications concerning such programs. 2 hr. rec., 3 hr. lab.



342. **Advanced Production Control.** 3 hr. PR: I.E. 250. A study of the different mathematical models useful in the design of effective production control systems. The various models to be covered include: static production control models under risk and under uncertainty, dynamic models under certainty, under uncertainty, and under risk.
353. **Applied Mathematical Programming.** 3 hr. PR: I.E. 250 or consent. Application of the assignment, transportation, and simplex algorithms to typical industrial and economic problems. The methods and computational efficiencies of the revised simplex and other algorithms are also studied and compared with the conventional methods. Computational methods of duality and the dual-simplex and primal-dual algorithms are covered. The following special topics are also included: effect of changes or addition of vectors, secondary constraints, the decomposition principles, fixed changes (intercepts), upper bound constraints, and transshipment. 3 hr. rec.
358. **Special Topics in Systems Analysis and Operations Research.** 3-6 hr. PR: Consent. Special topics from recent developments in operations research and related fields. Special emphasis will be placed on interests of current graduate students.
360. **Human Factors System Design.** 3 hr. PR: I.E. 260. A study of the theoretical aspects and practical applications of man/machine relationships as they influence future system design. In this course the student will examine human limitations with respect to the acceptance of information, decision making, and the ability to transmit the result of such decisions to the controlled equipment systems for the purpose of obtaining design optimization. 2 hr. rec., 3 hr. lab.
368. **Advanced Problems in Human Factors.** 1-3 hr. PR: I.E. 260 or 360 and graduate standing. Special problems relating to one of the areas of human factors such as simulation, controls, vigilance, maintainability, etc.
370. **Budget Control.** 3 hr. PR: I.E. 270. Principles involved in the preparation of budgets by functional divisions and the application of divisional budgets as control media. 3 hr. rec.
377. **Advanced Engineering Economy.** 3 hr. PR: I.E. 277. Special emphasis on depreciation, engineering and economic aspects of selection and replacement of equipment; relationship of technical economy to income taxation and load factor and capacity to economy. 3 hr. rec.
381. **Integrated Data Processing.** 3 hr. PR: I.E. 281 and consent. Advanced work in electronic data-processing systems and procedures design. Case studies of integrated data-processing systems. Course projects will include individual use of a computer in management data-processing analysis problems. 3 hr. rec.
385. **Digital Computer Applications.** 1 hr. PR: Graduate standing in Engineering, Physical Science or Mathematics. Introduction to methods of digital computation and study of the programming process with emphasis on coding with an automatic programming language for scientific problems (FORTRAN). The student will have considerable opportunity to analyze engineering and scientific problems using the facilities available at the University Computer Center. 2 hr. rec., 3 hr. lab. (5-week period.)
431. (C.E. 302). **Traffic Flow Theory.** 3 hr. PR: I.E. 213 and C.E. 439 or consent. Topics to be included are hydrodynamic, car-following, and queueing theory models of traffic flow. Particular emphasis will be given to the applicability of these models to true traffic situations. Other topics to be covered will be traffic simulation, freeway flow models, expressway surveillance, pedestrian and traffic delay at traffic signals, turning at intersections, parking problems, merging traffic or limited access facilities. 3 hr. rec.
452. **Queueing Theory.** 3 hr. PR: I.E. 213 and 215. Best operating conditions for systems involving waiting times. Elements of stochastic processes. Single-

channel and multi-channel models. Computational methods, including Monte Carlo techniques. Applications to problems such as maintenance and inventory control. 3 hr. rec.

- 453. **Theory of Linear Programming.** 3 hr. PR: I.E. 213 and I.E. 251 or consent. Extreme point solutions and their generation. Development of the simplex procedure. Duality problems in linear programming. Revised simplex procedure. Degeneracy procedures. Transportation problems. Selected topics related to linear programming. 3 hr. rec.
- 454. **Inventory Theory.** 3 hr. PR: I.E. 215. A study of techniques used in the optimization of inventory systems. Elements of static, deterministic inventory models, and static, stochastic inventory models. Dynamic inventory models. Selected topics related to inventory analysis. 3 hr. rec.
- 455. **Probability Theory for Engineers.** 3 hr. PR: I.E. 215. Study of probability theory and its application to industrial systems with particular emphasis on inventory systems, queueing models, maintenance, reliability, and quality control. Areas of study include mathematical models of random phenomena, basic probability theory, mean and variance of a probability law, probability laws and their application to inventory and queueing theory, expectation of a random variable, cost and profit as functions of random variables.
- 456. **Applied Stochastic Processes.** 3 hr. PR: I.E. 215, I.E. 251, I.E. 455. Study of stochastic systems with particular emphasis on application to inventory and queueing theory. Areas of study include conditional probability, Poisson processes, counting processes, renewal processes, Markov chains with discrete and continuous parameters.
- 480. **Seminar.** 1-6 hr. PR: Consent. Discussion of research in industrial engineering and special problems.
- 497. **Research.** 1-15 hr.

## **MECHANICAL ENGINEERING**

Students must comply with the rules and regulations as outlined in the general requirements for graduate work in the College of Engineering. A graduate student electing Mechanical Engineering as his major should have had the equivalent of an E.C.P.D.-accredited undergraduate degree in Mechanical Engineering or be willing to remove any deficiencies prior to starting on a graduate program. In addition, a graduate student in the Department of Mechanical Engineering must comply with the departmental requirements as outlined below.

### **Master of Science in Mechanical Engineering**

*Courses.* No rigid curriculum is set up for the M.S.M.E. degree. Certain general requirements must be met, however, by all candidates for this degree. Each student, in concert with his adviser, is expected to develop a plan of study, as soon as possible, indicating his courses and the area of his thesis interest. The plan should include at least six semester hours of advanced mathematics beyond differential equations and may also include courses in physics or chemistry in the 200 to 400 series. A minimum of twelve hours should be taken in Mechanical Engineering courses, with two-course depth in at least one major area. The remaining courses may be selected from other departmental offerings in the College of Engineering when particularly suited to the

objectives of the student. In general, at least one-half of the hours listed in the plan should be at the 300-400 level. No 200-level course that is required in the undergraduate curriculum in Mechanical Engineering may be taken for graduate credit. Any deviation or modification of the plan shall be subject to prior approval of the adviser.

*Thesis.* A thesis is normally required of all candidates for the degree of Master of Science in Mechanical Engineering.

*Final Examination.* Each candidate for the M.S.M.E. degree shall be required to pass a final examination administered by his advisory committee. This examination may be written or oral or both and may cover material in the courses or thesis area of the student.

## **The Degree of Doctor of Philosophy**

Students intending to pursue a Ph.D. program in Mechanical Engineering should have earned a B.S. or M.S. degree in Mechanical Engineering or an equivalent curriculum. While it is possible for a student with a B.S. degree to enroll directly in the Ph.D. program, it is usually advisable for him to earn the M.S.M.E. first. An exception might be indicated for anyone planning to enter the teaching profession or on a special doctoral support program.

As with the M.S.M.E. program, the courses of study are selected to fit the individual interests and objectives of the student, with proper attention given to the rounding out of related areas of study.

The research work for the doctoral dissertation is expected to represent a significant contribution to the art or science of engineering. It may entail a fundamental investigation into a specialized area, or a broad and comprehensive study of a novel system design. In either case, a high degree of creative and original effort is required to meet the standards of acceptability.

The student must pass a final examination in defense of his dissertation administered by his research committee.

## **Mechanical Engineering**

### **M.E.**

- 210. **Kinematics.** 3 hr. PR: M.E. 112 and Math. 18 or consent. Geometry of constrained motion, kinematic synthesis and design, spacial linkages. Coupler curves, inflection circle, Euler-Savary equation, cubic of stationary curvature and finite displacement techniques. 3 hr. rec.
- 222. **Mechanical Vibrations.** 3 hr. PR: Math. 18 and T.A.M. 104 or consent. Fundamentals of vibration theory. Free and forced vibration of one, two and multiple degree of freedom systems, transient analysis. Solution by Fourier and Laplace Transformation. Methods of Rayleigh, Holzer, and Stodola. Conservative systems and LaGrange's equation. 3 hr. rec.
- 226. **Friction, Lubrication, and Wear.** 3 hr. PR: Senior standing. Frictional phenomena in solids, liquids, and gases. Hydrodynamic lubrication theory and bearing design. Hysteresis, adhesion, abrasion, and wear effects. Examples of frictional behavior will be discussed and demonstrated. 3 hr. rec.
- 232. **Introductory Engineering Systems Analysis.** 3 hr. PR: Senior standing. A study of analogous and mixed systems. Similitude of mechanical, electrical, and acoustic dynamic systems. Dimensional analysis and theory of model design. 3 hr. rec.



240. **Problems in Thermodynamics.** 3 hr. PR: M.E. 141 or consent. Detailed study of thermodynamics systems with special emphasis on actual processes. The problems presented are designed to strengthen the background of the student in the application of the fundamental thermodynamic concepts. 2 hr. rec., 3 hr. lab.
244. **Introduction to Gas Dynamics.** 3 hr. PR: M.E. 144 or consent. The basic fundamentals of gas dynamics, one-dimensional gas dynamics and wave motion, methods of measurement, effect of viscosity and conductivity, and concepts from gas kinetics. 3 hr. rec.
252. **Heat Transfer II.** 3 hr. PR: M.E. 152. A continuation of M.E. 152, covering nonlinear extended surface; gas radiation; freezing; heat exchanger theory; recovery factor and high speed flow; and mass transfer. Also, periodic flow and application of the digital computer to problems in heat transfer. 3 hr. rec.
262. **Internal Combustion Engines.** 3 hr. PR: M.E. 101 or M.E. 141. The thermodynamics of the internal combustion engine; Otto cycle; Diesel cycle; two- and four-cycle engines, fuels, carburetion and fuel injection; combustion; engine performance, supercharging. 3 hr. rec.
264. **Heating, Ventilating, and Air Conditioning.** 3 hr. PR: M.E. 141 or consent. Methods and systems of heating, ventilating, and air conditioning of various types of buildings, types of controls and their application. 3 hr. rec.
266. **Steam Turbines.** 3 hr. PR: M.E. 141. The theory of fluid dynamics and the thermodynamics of the modern turbines; materials, construction details and design of important elements; influences on economy of variations in cycles and operative ranges. 3 hr. rec.
282. **Engineering Acoustics.** 3 hr. PR: Math. 18 and consent. Use of fundamental principles of mathematics and physics to develop the basic theories of sound. Application of these theories involving sound in closed areas, the various modes of sound transmission, noise control and psycho-acoustic criteria. 3 hr. rec.
284. **Introduction to Feedback Control Theory.** 3 hr. PR: Math. 18 and E.E. 105 or equivalent background. Introduction to automatic control systems and concepts of feedback. Transfer function analysis of the equations of motion. Transient and steady state response. Stability criteria using Nyquist, root locus and frequency response techniques. 3 hr. rec.
290. **Seminar.** 1-6 hr. PR: Junior, senior, or graduate status and consent.
294. **Special Topics.** 1-6 hr. PR: Junior, senior, or graduate status and consent.
299. **Mechanical Problems.** 1-6 hr. For junior, senior, and graduate students.
322. **Advanced Vibrations.** 3 hr. PR: M.E. 222 or consent. Dynamic and harmonic analysis of multiple degree of freedom and continuous linear systems. Lagrange's equations and matrix techniques. Use of analog and numerical techniques. 3 hr. rec.
326. **Interface Phenomena.** 3 hr. PR: M.E. 226 or consent. Phenomenological and molecular theories of adhesion. Interrelationship of adhesion and hysteresis, stability criteria and non-linear effects in bearings. Recent developments in lubrication theory. Elastohydrodynamic effects, surface energy criteria, and theories of wear. 3 hr. rec.
333. **Advanced Machine Design.** 3 hr. Stresses in indeterminate machine parts, experimental stress analysis. Design for high temperatures, pressures and speeds. Bearings and lubrication. Rotating discs and elastic stability and high speeds. Residual stresses and creep. 3 hr. rec.
340. **Advanced Thermodynamics I.** 3 hr. PR: M.E. 141. Definitions and scope of thermodynamics. First and Second laws, Maxwell's relation, Calpeyron relations, equation of state, thermodynamics of reactive systems, availability.

342. **Advanced Thermodynamics II.** 3 hr. PR: M.E. 340 or consent. Methods of statistical mechanics; concepts of temperature; perfect diatomic gases and crystalline solids, Jacobian equations of thermodynamics; grand potential function.
350. **Conduction Heat Transfer.** 3 hr. PR: M.E. 152 or consent. Analytical, numerical, graphical, and analog solutions of steady and non-steady heat conduction problems in isotropic and anisotropic solids. Representative topics include: thermal properties, extended surfaces, thermal stress, interphase conduction with moving interface, localized and distributed sources.
353. **Convection Heat Transfer.** 3 hr. PR: M.E. 152 or consent. Rigorous study of the fundamental mechanisms of the heat convection processes in both laminar and turbulent flows. Analytical, numerical, and analogical solution as applied to convective systems. Selected topics for discussion as related to student interest and study of current research publications.
355. **Radiation Heat Transfer.** 3 hr. PR: M.E. 152. Classical derivation of black body radiation laws; grey body and non-grey analysis; radiant properties of materials, radiant transport analysis, specular-diffuse networks, gas radiation, thermal radiation measurements: analytical, numerical solutions, and study of selected current publications.
364. **Turbomachinery.** 3 hr. PR: M.E. 101 or M.E. 141. A study of flow problems encountered in the design of water, gas, and steam turbines, centrifugal and axial flow pumps and compressors, design parameters.
380. **Engineering Similitudes.** 3 hr. PR: Consent. Development of the dimensional analysis concepts and techniques and their application in model design. Rational approach to the design of distorted models. Study of analogies from a standpoint of model-prototype relations. 3 hr. rec.
390. **Seminar.** 1-6 hr. For senior and graduate students.
394. **Special Topics.** 1-6 hr. For senior and graduate students.
422. **Random Vibrations.** 3 hr. PR: M.E. 222 or consent. Characterization of random motion. Response of linear time invariant systems. First and second failure problems. Fatigue under random excitation. 3 hr. rec.
440. **Irreversible Thermodynamics I.** 3 hr. PR: M.E. 340 or consent. Phenomenological treatment of the laws of dynamics and thermodynamics for irreversible processes in continuous media. The linear laws for combined irreversible phenomena including viscous dissipation, heat conduction, diffusion, chemical reactions and electric and magnetic effects, are developed taking into account Curie's principle and the Onsager relations. The principle of the minimum rate of creation of entropy is extended to establish criteria for the stability of stationary states. Tensor and variational methods are employed.
441. **Irreversible Thermodynamics II.** 3 hr. PR: M.E. 440. A continuation of M.E. 440 with emphasis on selected topics from such applications as thermoelectricity, anisotropic heat conduction, stability of fluid motion, thermal diffusion and separation, visco-chemical drag, electro chemical cells, and other coupled phenomena of physics or biological interests.
462. **Advanced Internal Combustion Engines.** 3 hr. PR: M.E. 262 or consent. Combustion in spark ignition engines; compression ignition engines; detonation; fuel-air ratios; heat losses; lubrication; efficiencies; two-stroke engines; four-stroke engines, performance, exhaust turbines; gas turbines. 3 hr. rec.
466. **Advanced Refrigeration.** 3 hr. PR: M.E. 264. Thermodynamics of vapor cycles, refrigerants, fluid flow, heat transfer, psychometrics, types of refrigeration and equipment required, application of refrigeration in industry, food preservation. 3 hr. rec.

490. Seminar. 1-3 hr. PR: Consent. Discussion, library readings, and individual study reports in the mechanical engineering field.
497. Research. 1-15 hr.

## **THEORETICAL AND APPLIED MECHANICS**

### **Master of Science in Theoretical and Applied Mechanics**

Students must comply with rules and regulations as outlined in the Guide to the Graduate Program in Engineering.

*Courses.* At least 30 semester hours are required for the degree of Master of Science in Theoretical and Applied Mechanics. At least 12 of these hours, exclusive of thesis, must be in the Department of Theoretical and Applied Mechanics. As many courses as are possible should be those restricted to graduate students only. A minor in one of the other branches of engineering, physics, or mathematics is possible.

*Thesis.* A thesis is usually required for the degree of Master of Science in Theoretical and Applied Mechanics, and is ordinarily for 6 hours credit. The thesis must conform to the general requirements of the Graduate School and to the additional requirements of the Department.

*Thesis Supervisor.* Each student will be assigned a thesis supervisor who will serve as chairman of his thesis committee.

*Final Examination.* On completion of his thesis, the candidate for the degree of Master of Science in Theoretical and Applied Mechanics will be given an oral examination by his thesis committee. Additional examiners may be called in for this examination.

### **The Degree of Doctor of Philosophy**

Graduate students electing Theoretical and Applied Mechanics as their major must have had the equivalent of the undergraduate courses in mechanics required for a bachelor's degree in any of the curricula in the College of Engineering.

A graduate student who has received a Master's degree from a school which has an undergraduate curriculum in the area of his Master's degree accredited by E.C.P.D. may pursue a Ph.D. degree in Theoretical and Applied Mechanics if he meets the other requirements of the Department.

Candidates for the Doctor of Philosophy degree, regardless of their specific major, must attain a proficiency in each of the following areas: (1) mechanics of solids, (2) mechanics of fluids, (3) dynamics, (4) experimental mechanics. In addition, each candidate must include at least four mathematics courses in his program of study.

#### **Theoretical and Applied Mechanics**

##### **T.A.M.**

300. **Advanced Mechanics of Materials I.** 3 hr. PR: T.A.M. 103 or consent. Energy methods; localized stresses; curved flexural members; torsion of noncircular sections; thick-walled cylinders and rotating disks; contact stresses. 3 hr. rec. Offered each fall.



301. **Theory and Application of Oscillatory Phenomena.** 3 hr. PR: T.A.M. 104. Study of oscillations or vibrations in acoustical, electrical, hydraulic and mechanical systems. 3 hr. rec. Offered in spring of even years.
304. **Perturbation Methods.** 3 hr. PR: Consent. A unified treatment of formal perturbation methods used in solving engineering problems with linear and non-linear differential equations that are unsolvable by elementary techniques. Topics to be covered include the conventional perturbation technique, inner and outer expansions, methods of multiple scales, the iteration technique and other current, related, methods of analysis. Offered each fall.
305. **Analytical Methods in Engineering I.** 3 hr. PR: Consent. A course designed to provide training in the applications of modern mathematics to engineering problems. Course content includes: index notation for determinants, matrices, and quadratic forms; linear vector spaces; linear transformations; eigen-value problems. Offered each fall.
306. **Analytical Methods in Engineering II.** 3 hr. PR: T.A.M. 305 or consent. Usually a continuation of T.A.M. 305. Course content includes: linear algebra, theory of functions, limits, continuity, and convergence; Banach and Hilbert spaces; functionals; representation theorems; applications to engineering problems. Offered each spring.
310. **Advanced Mechanics of Materials II.** 3 hr. PR: Consent. Membrane stresses in shells; bending of flat plates; two-dimensional elasticity; beams on elastic supports. 3 hr. rec. Offered each spring.
312. **Inelastic Behavior of Engineering Materials.** 3 hr. PR: T.A.M. 300. Rheological aspects of inelastic behavior, inelastic load-stress relationship for members subjected to axial, bending, torsion and buckling loads. Analytical stress-strain relationships and material modeling. Combined loading, interaction curves and their use. Statically indeterminate members loaded inelastically; inelastic buckling theory. 3 hr. rec. Offered fall of even years.
316. **Energy Methods in Applied Mechanics.** 3 hr. PR: Consent. Introduction to variational principle of mechanics and applications to engineering problems; principle of virtual displacements, principle of minimum potential energy, principle of complementary energy. Castigliano's theorem, Hamilton's principle. Applications of energy principles to theory of plates, shells, and stability. 3 hr. rec. Offered each fall.
318. **Continuum Mechanics.** 3 hr. PR: Undergraduate mechanics. A course designed to emphasize the basic laws of physical behavior of continuous media. Course content to include: analysis of stress; equations of motion and boundary conditions; kinematic analysis; rates of strain, dilatation and rotation; bulk time, rates of change; constitutive equations with special attention to elastic bodies and ideal fluids; energy equations and the first law of thermodynamics. 3 hr. rec. Offered each fall.
320. **Theory of Elasticity I.** 3 hr. PR: Consent. A basic solid mechanics course to include: Cartesian tensors; equations of classical elasticity, energy, minimum, and uniqueness theorems for the first and second boundary value problems; St.-Venant principle; extension, torsion, and bending problems. 3 hr. rec. Offered each fall.
325. **Experimental Stress Analysis.** 3 hr. PR: T.A.M. 103, 104. Introduction to some of the more common experimental methods of analyzing stress distributions. Classical photoelasticity, brittle lacquers, birefringent coatings, strain gage techniques and instrumentation, as applied to problems involving static, dynamic and stress distributions. 2 hr. rec., 3 hr. lab. Offered each fall.
326. **Advanced Laboratory.** 3 hr. PR: Consent. Applied engineering measurements and instrumentation dealing with mechanical phenomena as force, displacement, pressure, torque, velocity, and acceleration. Introduces students to various transducer, signal conditioning, and readout equipment. Time allowed for term project of specific student interest. Offered spring of even years.

330. **Instrumentation in Engineering I.** 3 hr. PR: Consent. Theory of measuring systems, emphasizing measurement of rapidly changing force, pressure, strain, temperature, vibration, etc. Characteristics of currently available instruments, methods of noise elimination, types of recording are studied. Students in small groups in laboratory operate modern instruments for first-hand experience. Of special value to students who will do an experimental thesis. 2 hr. rec., 3 hr. lab. Offered each spring.
342. **Biomechanics Seminar I.** 3 hr. PR: Consent. Introduction to the principles and terminology of biomechanics, guest lecturers in anatomy, physiology, and biology; critical review of research papers of current interest and a consideration of the sources and forms of the literature. 3 hr. rec. Offered each fall.
352. **Intermediate Dynamics.** 3 hr. PR: T.A.M. 104. Brief review of vectorial mechanics with emphasis on the dynamics of systems of particles and applications such as the motion of a rocket and orbital mechanics. Derivation of Lagrange's Equations from the principle of virtual work and D'Alembert's Principle and the application of these equations to engineering problems involving conservative and nonconservative systems. 3 hr. rec. Offered each fall.
353. **Advanced Dynamics I.** 3 hr. PR: T.A.M. 352. Continuation of T.A.M. 352. Mechanics of rigid bodies; theory of moments of inertia, angular momentum and kinetic energy. Poinso't's interpretation of torque-free motion, Euler's angles, Euler's dynamical equations, pitch, roll, yaw, spinning top, gyroscopes, etc. 3 hr. rec. Offered every spring.
360. **Flow of Non-Viscous Fluids.** 3 hr. PR: Consent. Introduction to potential theory, conservative force fields, continuity equation, energy equation, equation of state, ideal fluid. Derivation of Bernoulli equation. Complex variable with applications in potential flow. 3 hr. rec. Offered each fall.
380. **Special Problems in Mechanics.** 1-3 hr. PR: Consent. For junior, senior, and graduate students. Offered every semester and summer.
414. **Theory of Buckling.** 3 hr. PR: Consent. Fundamental theorems for the investigation of stability of mechanical systems. Application to discrete systems and development of stability equations for elastic bodies. 3 hr. rec. Offered spring of even years.
419. **Non-Linear Continuum Mechanics.** 3 hr. PR: T.A.M. 318 or consent. Study of the basic laws of continuous media in the language of generalized tensors. Emphasis on the structure of the constitutive equations for various classes of media with particular attention to elastic, plastic and viscoelastic media. 3 hr. rec. Offered spring of even years.
421. **Theory of Elasticity II.** 3 hr. PR: T.A.M. 320. Continuation of T.A.M. 320 to include: equations of classical elasticity in generalized coordinates; complex variables and potentials; plane stress and strain; various special problems. 3 hr. rec. Offered each spring.
424. **Theory of Thin Shells.** 3 hr. PR: Consent. Theoretical basis for analysis of shell-type structures. Material includes differential geometry of surfaces, current shell theories, and stability criteria. 3 hr. rec. Offered spring of odd years.
431. **Instrumentation in Engineering II.** 3 hr. PR: T.A.M. 330. Continuation of T.A.M. 330 with emphasis on transducers for static and dynamic measurement, and their use in practical measuring systems. 3 hr. rec. Offered fall of odd years.
440. **Photoelasticity.** 3 hr. PR: T.A.M. 300, 325. Theory of optics, birefringence, stress-optic law, polariscope, compensation. Techniques of model making, photography, polariscope use. Photoelastic coating methods and use of various reflective polariscopes. Data interpretation by various methods including principal stress separation by shear difference and graphical integration. 2 hr. rec., 3 hr. lab. Offered fall of odd years.



443. **Biomechanics Seminar II.** 3 hr. PR: T.A.M. 342 or consent. Continuation of T.A.M. 342 with emphasis on the medical applications of engineering and the techniques of mathematical modeling to biological systems. 3 hr. rec. Offered each spring.
454. **Advanced Dynamics II.** 3 hr. PR: Consent. Dynamics of continuous solids. Wave motion; study of string motion in detail in order to introduce methods for attacking more general problems such as vibration of beams, membranes and plates. Stress propagation in unlimited solids; dilatational, distortional, and surface waves. 3 hr. rec. Offered fall of odd years.
461. **Flow of Viscous Fluids.** 3 hr. PR: Consent. Derivation of the Navier-Stokes equations, continuity equations, equation of state, energy equation, energy dissipation, boundary layer phenomena. Simultaneous mass and heat transfer at the fluid boundaries. 3 hr. rec. Offered in spring of odd years.
480. **Advanced Independent Study.** 1-3 hr. PR: Consent. Advanced study in areas not covered by formal courses. Offered each semester and summer.
497. **Research.** 1-15 hr. I, II, S.

## School of Mines

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The School of Mines offers graduate curricula leading to the Master of Science degree in two fields—mining engineering and petroleum engineering. A student desiring to take courses for graduate credit in the School of Mines must first apply for admission to the Graduate School, and state the major field of his choice.

An applicant with a baccalaureate degree or its equivalent in the major field corresponding to the graduate study desired, from a department accredited by the Engineers' Council for Professional Development, will be admitted on the same basis as graduates of West Virginia University. Lacking these qualifications, an applicant must first fulfill the School of Mines' requirements in the field in which he is seeking an advanced degree.

Approval for candidacy for a graduate degree by faculty action is required to establish eligibility for a degree. A graduate student may request approval by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0 (B), based on all graduate courses in residence for which final grades have been recorded.

*Academic Standards.* No credits are acceptable toward an advanced degree which are reported with a grade lower than "C." To qualify for an advanced degree, a graduate student must have a grade-point average of at least 3.0 based on all courses completed in residence for graduate credit. Each candidate for a degree must select a major subject and submit a thesis showing marked attainment in that field.

### Engineering of Mines

#### E.M.

200. **Elements of Mineral Conservation. I.** 3 hr. PR: Open to any student in the University with junior standing. A study of the future demands for mineral resources including coal, water, oil, gas, ores, and industrial minerals and the causes of mineral loss in production and utilization and how to avoid or minimize them.



201. **Fire Control Engineering.** II. 3 or 4 hr. PR: Senior standing in an engineering curriculum or consent. The aspects involved in the control from fire, explosion and other related hazards. Protective considerations in building design and construction. Fire and explosive protection organization including fire detection and control. Lectures (3) and/or 3 hr. lab.
207. **Introductory Seismology.** I. 1 hr. PR: Physics 11. Earthquakes and the causes and area distribution; theory of elastic waves; the principles of seismograph construction, adjustment, and operation, interpretation and calculation of seismograms with exercises provided by records of the University seismograph station. 1 hr. rec.
209. **Mineral Preparation.** II. 3 hr. PR: T.A.M. 104, C.E. 115, or consent. Principles of preparation, beneficiation, and concentration of metallic, and non-metallic ores for further processing or utilization. 2 hr. rec., 3 hr. lab.
212. **Advanced Mining.** II. 3 hr. PR: E.M. 108 and PR or conc.: E.E. 105. Engineering principles, methods and equipment applied to mine transportation, hoisting, and drainage. 3 hr. rec.
213. **Mine Ventilation.** I. 3 hr. PR: E.M. 108, T.A.M. 104, and C.E. 115. Principles, purposes, methods and equipment pertaining to the ventilation of mines. 2 hr. rec., 3 hr. lab.
215. **Industrial Safety Engineering.** I. 2 hr. PR: Junior standing or consent. Analysis of problems of industrial safety and accident prevention, laws pertaining to industrial safety and health, compensation plans and laws, and industrial property protection. 2 hr. rec.
217. **Coal Preparation.** I. 3 hr. PR: E.M. 108, 209, or consent. Formation of coal, rank classification of coal, coal petrography, principles of preparing and beneficiating coal for market with laboratory devoted to sampling, screen analysis, float and sink separation, and use of various types of coal cleaning equipment. 2 hr. rec., 3 hr. lab.
218. **Advanced Mineral Preparation.** I. 3 hr. PR: E.M. 208, 209. The theory and practice of concentration of ores, and industrial minerals with special consideration to the more recent advances in the beneficiation of both ores and coal. 2 hr. rec., 3 hr. lab.
219. **Advanced Mining Methods for Vein Deposits.** II. 3 hr. PR: E.M. 108, T.A.M. 104. Methods and systems of mining other than flat seams. Emphasis placed on selection of methods in relation to cohesive strength of ore bodies and their enclosing wall rocks. Mining of anthracite is included. 3 hr. rec.
220. **Mine Design.** II. 3 hr. PR: E.M. 212, E.M. 241. A comprehensive design problem involving underground mining developments or design of surface plant or both, as elected by the student in consultation with the instructor. A complete report on the problem is required including drawings, specifications, and cost analysis. 9 hr. lab.
222. **Mine Equipment and Machinery.** II. 3 hr. PR: E.E. 106 and E.M. 212. Selection, installation, operation, and maintenance of mining equipment. 3 hr. rec.
223. **Mine Management.** II. 3 hr. PR: Math. 140, E.M. 212 and senior standing. Economic, governmental, social, and labor aspects of mining as related to the management of a mining enterprise. 3 hr. rec.
224. **Mining Engineering Problems.** I, II. 1-6 hr. PR: Senior or graduate standing. Investigation and detailed report on a special problem in mining engineering related to coal mining or mineral mining. Supervision and guidance by a member of the graduate faculty.
228. **Mine Equipment and Machinery Controls.** I. 3 hr. PR: E.M. 222 or consent. Principles, application and use of electric and hydraulic devices and circuits for protection and control of mine machinery and equipment. 3 hr. rec.

229. **Advanced Mining Equipment Applications. II.** 3 hr. PR: E.M. 228. Structural, mechanical, hydraulic and electrical characteristics of the more common items of mining equipment. Controls, electrical and hydraulic circuits, and mechanical transmissions with associated problems. Laboratory design of a control system for a mining machine. 2 hr. rec., 3 hr. lab.
230. **Elements of Geophysical Prospecting. I.** 3 or 4 hr. PR: Geol. 1, Physics 11. Principles, calculations and application of methods for locating subsurface oil, gas, and mineral deposits. Field investigation using instruments with 4 hr. section.
234. **Applied Geophysics. II.** 3 hr. PR: Physics 12 and Geol. 151 or consent. Origin of the universe and the planets, heat and age of the earth. Application of the science of geophysics in the location and analysis of earthquakes and in prospecting for oil and minerals.
241. **Mechanics of Ground Control in Mines. I.** 3 hr. PR: T.A.M. 102, Math. 140, E.M. 108 or consent. Structure of the earth's crust, bedding planes, joints, heterogeneity, mechanical properties of rocks, stress-time-deformation relationships in rocks, theoretical stress distribution about mine openings, practical effects, factors in mine pillar design, pillar bursts, creeps and squeezes, mining subsidence. 2 hr. rec., 3 hr. lab.
- 301, 302. **Advanced Mine Design. I, II.** Credit arranged. Advanced detail design and layout of coal mine plant, particularly incorporating new ideas of machines and mining methods.
351. **Coal Mining. S.** 3 hr. PR: Chemistry, 10 hr.; Physics, 8 hr.; and accompanied or preceded by general geology. Especially for students who are planning to teach mining subjects in high school. Not open to students taking E.M. 108 or 212. Hours arranged.
- 395, 396. **Graduate Seminar in Coal Mine Operation and Administration. I, II.** 3-6 hr. PR: B.S. degree and consent of Committee. Group discussion and analysis of problems related to the production, preparation, marketing, and utilization of coal with special assignments and emphasis in accordance with personnel background and field of interest of the individual student.
497. **Research. I, II.** 1-15 hr.

## Petroleum Engineering

### Pet.E.

206. **Natural Gas Engineering. I.** 3 hr. PR: Pet.E. 106, C.E. 115. Principles of natural gas production, transmission, distribution, processing, regulation, measurement, storage and analysis with a laboratory devoted to the principles of the equipment utilized in the above named operations. 2 hr. rec., 3 hr. lab.
216. **Petroleum Engineering Design. II.** 3 hr. PR: Pet.E. 232, Material Engr. 250. A comprehensive problem in design involving systems in oil and gas production, field processing, transportation and storage. Three 3-hr. labs.
224. **Petroleum Engineering Problems. I, II.** 1-6 hr. PR: Senior or graduate standing. Investigation and detailed report on a special problem in petroleum or natural gas engineering. Supervised by a member of the graduate faculty.
232. **Petroleum Reservoir Engineering. II.** 5-6 hr. PR: Pet.E. 236. Concepts and application of properties of rocks and rock-fluids systems which are fundamental to engineering analysis of petroleum reservoirs, mechanics of fluid flow in porous media, production by depletion drive, by frontal displacement, by water drive, and by segregation drive. 5 hr. rec., 3 hr. lab.
235. **Fundamentals of Well Logging. II.** 3 hr. PR: Math. 140, Pet.E. 106, or consent. Principles of the various well logging methods and related calculations

- with exercises in interpretation of data from actual well logs. 2 hr. rec., 3 hr. lab.
236. **Mechanics of Hydrocarbon Fluids. I.** 3 hr. PR: Physics 12, C.E. 115, E.M. 102, Pet.E. 106, Chem. 141. The qualitative and quantitative phase behavior of single and multicomponent hydrocarbon systems with emphasis on application to petroleum production engineering and petroleum reservoir engineering. 2 hr. rec., 3 hr. lab.
  237. **Composition and Properties of Oil Well Drilling Fluids. II.** 2 hr. PR: Pet.E. 106, Chem. 141 and C.E. 115. Principles of drilling fluid control including a laboratory for pilot testing, mud design procedures and measurement of composition and properties. 1 hr. rec., 3 hr. lab.
  240. **Secondary Recovery of Oil by Water Flooding. II.** 3 hr. PR: Pet.E. 232. Theory of immiscible fluid displacement mechanism, evaluation and economics of water flood projects, and oil field flooding techniques. 3 hr. rec.
  241. **Petroleum Management Engineering. II.** 4 hr. PR: Pet.E. 106, 232, 235, Econ. 52. Petroleum property evaluation, factors influencing oil economics, values of money and taxation of oil properties. Calculation of reserves and future reservoir performance, decline curves, production and formation testing and special aspects of management of oil and gas properties. 4 hr. rec.
  242. **Well Stimulation: Fracturing. I.** 3 hr. PR: Pet.E. 106, 241. Theory of hydraulic fracturing, fracturing tools, fracturing fluids, fracturing orientation; propping agents and general design treatment for optimum profitability. 3 hr. rec.
  243. **Advanced Secondary Recovery. I.** 3 hr. PR: Pet.E. 240. Theory and practice of secondary recovery of oil by gas flooding, miscible fluid injection, in situ combustion, and heat injection. 3 hr. rec.
  301. **Advanced Petroleum and Natural Gas Engineering Design. I, II.** Credit arranged. Advanced detail design problems in some phase of petroleum and natural gas exploration, production, and transportation, particularly incorporating new ideas, machines and methods.
  302. **Fluid Flow in Porous Media. I.** 3 hr. PR: Pet.E. 232 and Math. 140 or consent. Intensive study of theoretical and practical aspects of the physical principles of hydrodynamics in porous media. 3 hr. rec.
  497. **Research. I, II.** 1-15 hr.



# College of Human Resources and Education

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The College of Human Resources and Education includes the Divisions of Clinical Studies, Education, Family Resources, and Social Work, and the Human Resources Research Institute. Established in 1965, the College brings together several disciplines and professions devoted to the study and maximum development of human talent and resources, whether in the context of the school, the family or the community. Programs of instruction, research, and extended service are carried out in each of the divisions of the College and in close cooperation with the related departments and divisions in other sectors of the University.

## Admission and Curriculum

It is the responsibility of all applicants to apply for admission to the Graduate School through the Office of Admissions. All candidates for graduate degrees must conform to the general regulations of the Graduate School. Such general regulations and the steps to be followed in the admissions process are covered in Part II of this bulletin. Certain details in regard to admission to specific graduate programs of the College are provided on following pages. Additional information may be obtained by writing to the director of the division in which the graduate program is offered or by writing to the Dean of the College.

The curriculum and degree requirements of the various master's degree programs of the College are shown in each of the respective divisional sections. It is the responsibility of the student to take steps to insure that he is properly informed in regard to the requirements of the degree toward which he aspires and/or the certification standards to which he may wish to conform. Members of the faculty in general, and the student's adviser in particular, will offer counsel to the student on these matters on request.

## The Degree of Doctor of Education

The Doctor of Education degree is offered with the following major areas and emphases:

1. Curriculum and Instruction
  - a. Educational Psychology
  - b. Elementary Education
  - c. Health Education
  - d. Industrial Arts Education
  - e. Music Education
  - f. Physical Education
  - g. Reading
  - h. Safety Education
  - i. Special Education

2. Counseling and Guidance
3. Education Administration

*Admission.* Individuals who wish to pursue a program leading to the Doctor of Education degree must be admitted to the Graduate School. All applicants for admission to the doctoral program in the College of Human Resources and Education must submit scores on the Aptitude Test of the Graduate Record Examination and comply with each of the General Regulations of the Graduate School outlined in Part I and Part II of this bulletin. Acceptance for study toward the doctoral degree in a specific area of concentration will be based on prior academic achievement including a cumulative grade-point average of 3.0 or above and a satisfactory score on the general aptitude test of the Graduate Record Examination or other appropriate measure of academic aptitude and an interview by the Doctoral Admissions Committee during the Preliminary Examination. Students having a cumulative grade-point average of less than 3.0 but having a satisfactory score on the Graduate Record Examination or other appropriate measure of academic aptitude may be admitted provisionally; final acceptance will be contingent upon the results of the Preliminary Examination. Students who meet the standards for admission set forth by the various programs will be assigned a temporary adviser by the Dean of the College of Human Resources and Education.

*Preliminary Examination.* The student must make application through his temporary adviser to the chairman of Graduate Affairs to take the Preliminary Examination. Usually, the examination is taken after tentative admission to the program and completion of six to twelve hours of doctoral work at West Virginia University. A maximum of eighteen (18) hours credit of doctoral work completed at West Virginia University prior to the preliminary examination may be counted toward the degree.

The purposes of the preliminary examination are to discuss with the student his proposed area of doctoral study, and to make appropriate recommendations to the Dean of the College concerning his acceptance into an area of concentration and acceptability of prior work to meet program requirements.

The composition of the preliminary examining committee shall include, at least, the chairman of graduate affairs, the coordinator of the major program, the coordinator(s) of minor program(s), and the student's temporary adviser. Prior academic achievement, professional experiences, test results, and other evidences of competence in areas essential for successful completion of the Doctor of Education Degree will be taken into consideration.

*Doctoral Committee.* Having received an affirmative recommendation from the preliminary examination committee to continue doctoral work, a permanent adviser to serve as chairman of the student's doctoral committee and at least four additional committee members will be recommended by the student and approved by the faculty members involved, the director of the appropriate division, and the Dean of the College. At least one member of the doctoral committee must come from a supporting discipline outside the College of Human Resources and Education and no more than three from any single division within the College.

*Curriculum.* The final determination of the program of course work and research is the responsibility of the student's doctoral committee. The Doctor of Education degree is not awarded on the basis of the completion of any set number of credits but is awarded on the basis of demonstrated academic achievement and scholarly competence. The minimum course work shall be 70 semester hours of graduate work, excluding dissertation credit but including credits of relevant graduate work completed at the master's degree level. A minimum of 24 of the 70 semester hours shall be in the area of major concentration and a minimum of 24 of the 70 hours from a minor area of concentration in a supporting or related discipline. At least one-half of the semester hours taken within the College and at least one-third of the hours taken outside the College shall be courses at the doctoral level.

*Admission to Candidacy Examination.* The purposes of the admission to candidacy examination are to assess the quality of the student's academic achievement, to review the student's program of course work, to approve a proposed outline of dissertation research, and to admit the student to formal candidacy for the degree.

The examination may be taken after at least two-thirds of the student's program of course work has been completed but prior to the dissertation phase of the program. The admission to candidacy examination consists of two parts: (a) a written examination, and (b) an oral examination. The candidate must pass the written examination prior to taking the oral portion. The written examination will include a common "foundations" section (history and philosophy of education, research design and statistics, social and psychological foundations) and specifically prepared written examinations in the major area of concentration and in the area of concentration in the supporting discipline. The written examination may be repeated one time and, upon consent of the Dean, director of the appropriate division, and the coordinator of major program, may be repeated a second and third time. At least six months must elapse between repeated examinations.

The oral portion of the admission to candidacy examination will be administered by the student's doctoral committee at the call of and under the direction of the committee chairman after successful completion of written portion of examination. The oral portion of the examination at which time the student must present and defend the prospectus for his doctoral dissertation, may be repeated one time and on recommendation of the doctoral committee, may be repeated a second time. At least six months must elapse between repeated examinations. On successful completion of the admission to candidacy examination, the student will be admitted to formal candidacy for the doctoral degree.

*Dissertation.* The candidate must submit and justify an outline or a prospectus for his doctoral dissertation at the oral portion of the admission to candidacy examination. The doctoral committee must review and *approve*, *approve with change*, or *reject* this outline or prospectus. The student shall consult with all members of the doctoral committee and with other appropriate members of the University faculty during the dissertation phase of his program.



*Final Oral Examination.* The student will be admitted to a final oral examination upon completion of his dissertation and after he has fulfilled all other requirements set by his committee. This examination will be conducted by his doctoral committee and will be open to all members of the University faculty. The candidate will not be recommended for the doctoral degree if he receives more than one unfavorable vote from his doctoral committee.

## **Certificate of Advanced Study in Education**

This program is designed to prepare school and related personnel who wish professional training beyond the Master's degree. Candidates for this Certificate may choose from among the following areas of study for their area(s) of concentration: (a) Administration and Supervision; (b) Curriculum and Instruction; (c) Counseling and Guidance, Reading, and Special Education; and (d) Physical Education. Persons interested in this certificate should consult with the director of the appropriate division or the Dean of the College of Human Resources and Education.

### **Prerequisites for Admission to the Program**

1. General requirements for admission to the Graduate School of WVU.
2. A Master's Degree with a grade-point average of 3.0 or higher.
3. A minimum of three years of teaching or closely related educational experience.

### **Requirements for Admission to Candidacy**

1. Evidence through examination, personal letter, and personal interview of general proficiency, acceptable standards of oral and written communication, and good health.
2. Satisfactory completion *in residence* at WVU of at least 6 semester hours of approved course work beyond the conferring of the Master's Degree.
3. Students must submit scores on the General Aptitude Test of the Graduate Record Examination.

### **Requirements for Completion**

*The Program.* An approved program consisting of a minimum of 30 semester hours earned above the Master's degree including 24 hours of course work in the College of Human Resources and Education or in closely related fields and 6 hours of research.

At least 24 semester hours of the work credited for this Certificate must be done in residence at West Virginia University. This requirement includes the 6 hours of research which may be conducted apart from the physical limits of the University but must be done under the direction and supervision of the chairman of the student's graduate committee. A maximum of 6 semester hours earned in residence at another approved graduate institution or in West Virginia University Extension may, if approved by the student's adviser, be allowed toward credit for the Certificate. The minimum period of full-time graduate study in residence at West Virginia University is one semester or one full summer session.

*Final Examination(s).* Upon completion of all requirements including the research report, the candidate will be admitted to a final oral examination by his graduate committee.

*Time Limitation.* All requirements must be completed within seven years immediately preceding the awarding of the Certificate.

## **HUMAN RESOURCES RESEARCH INSTITUTE**

The Institute is the major research facility of the College of Human Resources and Education. It does not offer a program of studies leading to a degree but provides research support, research consultation, and opportunities for participation in multidisciplinary or programmatic research projects for faculty and graduate students in all divisions of the College as well as the Departments of Psychology and Sociology in the College of Arts and Sciences. Research of a basic, applied, or methodological nature is encouraged and supported by the Institute.

A number of graduate assistantships are available in the Institute. Students admitted to graduate study in any division of the College and in the Departments of Psychology and Sociology are eligible for these assistantships. Inquiries may be directed to the director or to the chairman of the department in which the student is registered.

## **DIVISION OF CLINICAL STUDIES**

The Division of Clinical Studies includes the programs of Counseling and Guidance, Reading, Rehabilitation Counseling, Special Education, and Speech Pathology and Audiology. The Division offers three programs leading to the Master of Arts and two programs leading to the Master of Science degree. The degree of Doctor of Education is offered in the areas of Counseling and Guidance, Reading, and Special Education.

The candidates for graduate degrees must meet the general regulations of the Graduate School, the College of Human Resources and Education, and specific regulations as required by the Division programs. Descriptions of the admission, curriculum, and degree requirements are shown in the respective program sections.

A person who wishes to pursue a graduate program leading to a degree in the Division of Clinical Studies must meet the general requirements for admission to the Graduate School and the College of Human Resources and Education. Additionally, to be admitted to candidacy for the master's, certificate of advanced study, or doctoral degrees, prospective candidates must meet the appropriate requirements and procedures described herein.

## Admission to Graduate Study at the Master's Level

To be admitted to graduate study leading to the master's degree, the applicant must:

1. Have attained a 2.5\* undergraduate grade-point average;
2. Have attained a Verbal score of at least 400 on the General Aptitude Test of the Graduate Record Examination; and
3. Have submitted to the Division Admissions Committee a minimum of three letters of recommendation from previous instructors and/or employers attesting to the applicant's ability to pursue graduate study and potentially to function in a professional capacity.

## Conditional Admission

Applicants who have: (1) attained an undergraduate grade-point average of at least 2.0 but less than 2.5, and/or (2) failed to attain a score of at least 400 on the Verbal section of the General Aptitude Test of the Graduate Record Examination may be admitted conditionally as "Probationary graduate students" in the Division for a period not to exceed the completion of 15 graduate hours, 9 of which must be as a full-time resident student. No later than the end of the semester in which the student completes his 15th hour, he shall be reclassified as a regular graduate student only if he has attained a grade-point average of at least 3.0 computed on all graduate hours attempted. Any student who does not attain a 3.0 average for all graduate hours attempted may not continue further study and is not eligible to receive the Master's degree.

## Admission to Candidacy for the Master's Degree

To be admitted to candidacy for the Master's degree in any of the program areas in the Division of Clinical Studies a prospective candidate must:

- (1) Be classified as a regular graduate student;
- (2) Submit to the appropriate program area a proposed program of study endorsed by his faculty adviser; and
- (3) Complete the initial program-planning examinations.\*\*

## Admission to Candidacy for the Certificate of Advanced Study

The Certificate of Advanced Study (CAS) is regarded primarily as a terminal degree for those qualified individuals who do not plan to pursue the doctorate. As such, it is separate and distinct from the doctoral programs. Therefore, completion of the requirements for the CAS does not necessarily imply that such coursework would be acceptable for a doctoral program should the student subsequently choose to pursue the doctorate.

\*All grade-point averages discussed refer to a four-point system where 4.0 is an "A".

\*\*The program-planning examinations are *mandatory* during the first semester that students plan graduate study in the Division. Examinations usually are held on the second and third Saturdays following the week classes begin in any given semester. Specific time and location are available in both the registration center and the Division. A student who fails to abide by this regulation shall not, except in the most highly unusual circumstances, be allowed to pursue coursework in the Division that semester. This includes extension coursework and coursework at the Kanawha Valley Graduate Center.



The broad criteria for the CAS are: an appropriate master's degree or its equivalent with a minimum graduate grade-point average of 3.0. Students interested in the possibility of pursuing the CAS should consult with faculty in the appropriate program areas.

### **Admission to Graduate Study Leading to the Doctorate**

Students interested in pursuing the doctorate are admitted to candidacy in three different phases. The first phase consists of application for admission to the WVU Graduate School using standard procedures. The second phase consists of the Preliminary Examination and formal admission to doctoral study in the program area of the Division. The third phase consists of the Admission to Candidacy Examination. Details of these major steps are available on page 187 under "The Degree of Doctor of Education."

### **Special Requirements for the Master's Degree in Counseling and Guidance, Reading, and Special Education**

1. No student may be awarded a Master's Degree unless he has a minimum grade-point average of 3.0 on all work taken for graduate credit. (A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.)

2. No student may repeat a required graduate course more than once.

3. Fifteen semester hours of approved work in extension may apply toward the completion of degree requirements, if no work is transferred from another institution.

4. No more than six semester hours of approved transfer credit from another institution may be applied toward the degree.

5. No more than nine hours of extension work may be used toward the degree if six hours of transfer credit from another institution is applied toward the degree.

6. Requirements for the Master's Degree must be completed within a period of seven years.

7. Final examination (oral, written, or both, at the discretion of the candidate's adviser and the Department of Counseling and Guidance).

A candidate who fails the final Master's degree examination may be given (upon written consent of his advisory committee) a second examination not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

### **Counseling and Guidance (Master of Arts Degree)**

#### **General Requirements**

##### **I. Admission to Program**

A. Completed application made first to: Office of Admissions, WVU.

B. Counseling and Guidance Program application including names for references must be sent to the Counseling and Guidance office.

C. Minimum 2.5 undergraduate grade-point average.

- D. Bachelor's degree and course work in appropriate areas.
- E. Satisfactory references and personality to indicate success as a counselor.
- F. Contact with adviser by mail or conference prior to registration for courses. (The Counseling and Guidance program requirements are distributed at this time.)
- G. Program Planning Exam must be taken in the first semester after initial registration.
- H. Program planning contract completed with adviser and department.

Students will not be classified as "regular graduate students" until the above requirements have been completed. Applicants who do not meet the above criteria can not be admitted. No students are admitted on probation, and none are admitted to other than degree or certification programs.

The Counseling and Guidance office is located in 504 Forestry Tower; phone (304) 293-2691.

## II. Admission to Candidacy

- A. Completion of requirements within Blocks A and B below.
- B. Completion of the Master's Candidacy Preliminary Examination which is part of practicum preregistration. Students must make application for the Master's Preliminary Examination during registration or by mid-term prior to the administration of the examination, which is given the next to last Saturday of each term.

## III. Master of Arts Degree and Professional Counselor Endorsement\*

- A. Completion of the required (all numbered) courses in Blocks A-I, B and C plus 9 hours approved by the adviser from A-II or;
- B. Completion of the required (all numbered) courses in Blocks A-I, B and C plus 3 hours approved by the adviser from A-II and an approved thesis.
- C. A minimum graduate grade-point average of 3.0.\*\*
- D. Successful completion of the Master's Comprehensive Examination at the close of the practicum, after clearance from the Graduate School.
- E. Recommendation of the faculty.

Required for West Virginia Certification, not for degree

- F. A valid professional teaching certificate at the level for which counseling and guidance endorsement is desired.
- G. Two years of successful educational experience in teaching or guidance and counseling or a combination thereof at the level for which an endorsement for counseling and guidance is desired.

## IV. Temporary License in Counseling and Guidance: Guidance Workers\*\*\*

An individual with a valid professional teaching certificate wanting a professional certificate may be granted a *temporary license*, valid for one year, endorsed for serving as a COUNSELOR AT THE LEVEL OF HIS PROFESSIONAL CERTIFICATE provided he:

- A. Secures the recommendation of the superintendent who agrees to employ him.
- B. Submits a plan which has University approval for the completion of the guidance program.
- C. Recommendation at West Virginia University will be made with completion of the following four courses leading to 12 hours of graduate credit:
  1. Basic Course in Guidance
  2. Sensitivity to Human Relationships
  3. Elementary Statistics
  4. Human Appraisal

## V. Inclusion of Renewal

The holder of a temporary license endorsed for serving as a counselor may have his license reissued for a one-year, provided:

- A. He completes, subsequent to the issuance of his last license, six semester hours of graduate credit in courses prescribed for the counselor endorsement.
- B. The graduate institution where he expects to complete his counseling program must:
  - a. verify that the credits earned are prescribed by the West Virginia Board of Education for the issuance of this endorsement;
  - b. recommend the reissuance of the license based upon the applicant's satisfactory performance in his specialization.
- C. The employing superintendent must also:
  - a. certify that the applicant is the best qualified person available;
  - b. recommends the reissuance of the license based upon successful experience.

\*While 36 hours represent the minimum academic requirements, proficiency in counseling is the prime criterion for completion of the counseling and guidance program. This may mean that in some cases on the basis of the preliminary exam, practicum performance, and/or comprehensive exam additional course work or experience may be required to meet this level of competency.

Prospective candidates for the Counseling and Guidance program should carefully examine their motives, personal strengths, and weaknesses to determine if limitations in their capacity for intense interpersonal relationships may restrict or impede their acquiring the expected level of counseling proficiency and application of academic and research skills.

\*\*Required for students admitted beginning second semester 1967-68.

\*\*\*Temporary License in Counseling and Guidance. The temporary license as a Guidance Worker replaces the Counselor Permit as of September 1, 1968.

## Course Requirements

### Block A Courses

#### A-I Counseling and Guidance Foundations: (10 hours)

C&G 302—Human Relationships. 2 hr.\* (S or U)\*\*

C&G 303—Basic Course in Guidance. 3 hr.

Stat. 311—Statistical Methods. 3 hr.

C&G 304 (or Rehab. 304).—Vocational Development and Occupational Choices. 2 hr.



## A-II Behavioral Science Foundations Courses: (9 hours)

Courses shall be selected *with the consent of the adviser* from approved electives in the Psych-Socio foundations listed below to complete the (9) hours required in this block. Courses which will be approved in this block are those external to the Department of Counseling and Guidance and designed to better understand human behavior and to supplement counseling. Demonstration of proficiency in the areas of Personality Theory, Learning Theory, and Research will be required to pass the Master's Preliminary Examination. Credit in research is required for certification.

Personality Theory***	Anthropology
Learning Theory***	Economics
Research***	Sociology
Advanced Educational Psychology	Abnormal Psychology
Child Development	Behavior Problems in the School
The Exceptional Child	Specialized course from area of
Adolescent Development	concentration, one course
Social Psychology	allowed
Mental Hygiene	

Block A-II in conjunction with undergraduate preparation should provide the expected knowledge needed for the Master's Preliminary Examination on personality theories, human growth and behavior, and basic sociological concepts. Skill and knowledge in interpreting research is expected to be developed in each course throughout the sequence. Campbell's *Form and Style in Thesis Writing* will be used as the standard reference of style for preparation of papers; familiarity and competency in its utilization is necessary. The Master's thesis should be prepared under the Graduate School regulations on theses and dissertations.

\*Hours shown are the minimum requirements. Some 2-hour courses can also be taken for 3 hours of credit.

\*\* (S or U) indicates courses which are graded as satisfactory or unsatisfactory depending on whether the student reaches the required level of proficiency.

\*\*\*Students who may move on into the doctoral program should prepare themselves in depth in these required areas.

## Block B Courses: (6 hours) (PR: Second semester status)

### B-I Courses

C&G 305. *Theory and Practice of Human Appraisal*. 3 hr. PR: C&G 303 or proficiency exam in Statistics. Statistics 311 is recorded as PR.

C&G 306. *Counseling Theories and Techniques*. 3 hr. PR: 15 hr. completed including Block A-I by completion of C&G 306, and consent.

### B-II Preliminary Examination

The Master's Candidacy Preliminary Examination which can be taken concurrently with C&G 306 must be taken prior to registration for the practicum. This exam, replacing the objective portion of the Master's Comprehensive Examination, will be held on Saturday two weeks before the end of each term. Students must register with the departmental secretary by mid-term prior to the exam. This exam covers the fundamental material from Personality Theory, Learning Theory, and Research; plus material from 302, 303, 304, 305, and

306 which is designed to bring knowledge in the guidance foundations to the criterion level expected of all counselors.

**Block C Courses: (11 hours)**

C&G 307—Application of Counseling Techniques.\* 3 hr. (S or U)

C&G 308—Organization and Development of Counseling and Guidance Services.  
2 hr.

C&G 309—Group Techniques in Counseling and Guidance. 2 hr.

C&G 385—Practicum in Counseling. 4 hr. (S or U)

(NOTE: C&G 307-385 will be combined with C&G 308 and 309 in the Summer program for the Practicum Block.)

\*C&G 307 should be taken concurrently with C&G 306 by fall term students. Summer students will take C&G 307 with the regular Practicum Block (Block C). 308 and 309 are only offered in summer and spring terms.

**Special Requirements**

1. Students completing their degree under a previous program agreement must meet with their adviser or departmental adviser as soon as possible and *prior* to the day of registration for their next term to define any necessary revisions. Previously *approved* work will be credited; however, the remaining courses must be selected from within the present program offerings with the consent of the adviser.

2. Satisfactory advising cannot be handled at registration time. Students needing advising are required to make an appointment to meet with their adviser or with the departmental adviser prior to the registration period.

3. Courses are sequenced so that full-time resident students should plan to finish Block B in the fall term and Block C in the spring.

4. Admission to practicum during the summer is limited. The probability of admission to practicum is much higher during the Fall or Spring semesters.

5. Beginning summer 1969 the status of special student and probationary student was dropped from Counseling and Guidance admissions.

6. Only 9 hours of extension work may be applied to the Master's degree from the Counseling and Guidance program.

7. No more than 9 hours will be credited in Extension for any program prior to the completion of 6 hours in residence at the University.

8. No more than 12 semester hours of approved transfer credit from another institution may be applied toward the degree. Transfer course work will be considered from Block A and B excluding 306.

9. No more than 15 hours of combined extension and transfer credit may be used toward the degree.

10. Requirements for the Master's Degree must be completed within a period of seven years.

11. A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.

12. No student may repeat a required graduate course more than once.

13. At the discretion of the candidate's departmental advisory committee, a final oral exam may be required after the written comprehensive exam.

14. A candidate who fails the final Master's degree examination may, upon written consent of his advisory committee, be given a second examination

not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

## **Counseling and Guidance (Certificate of Advanced Study)**

### **Admissions**

1. Completion of a master's degree in *Counseling and Guidance* or equivalent comparable to West Virginia University master's degree in Counseling and Guidance with approved practicum experience.
2. A minimum graduate grade-point average of 3.0.
3. A total score of 1000 on the Graduate Record Examination aptitude test.
4. Personal interview with faculty members in Counseling and Guidance.
5. Demonstration of competency in counseling, measurement, statistics, and the guidance function in education as evidenced by references and appropriate examinations.
6. Evidence of successful appropriate work experience.
7. Written justification for choice in area of specialization.
8. Three references for recommendation.
9. Plan of study approved by assigned adviser.

### **Areas of Specialization**

Elementary School Counseling  
Student Personnel Work  
Employment Counseling  
Pupil Personnel Services

Secondary School Counseling  
Correctional Counseling  
Research in Counseling

### **Requirements for Graduation**

- A. Completion of 36 semester hours of approved graduate work.
- B. A minimum grade-point average of 3.2 on all course work attempted under the Certificate of Advanced Study Program.
- C. Demonstration of competencies as a specialist in chosen area of specialization.
- D. Recommendation of the department.

### **Program**

1. 12 semester hours core from C&G:  
363—Advanced Theories of Counseling. 3 hr.  
366—Manpower Utilization and Development. 3 hr.  
369—Theory & Practice of Student Appraisal. 3 hr.  
385—Practicum: Advanced—Specialized applications of counseling. 3 hr.
2. 12 semester hours selected with adviser's consent in specialty area of advanced courses external to the C&G program area.
3. 6 hours to achieve competencies in consumption and production of field research.



4. 6 hours research problem in area of specialization.

### **Residency (Minimum)**

- A. 1 semester or 2 summers (12 hr.) on campus.
- B. Program completion of 12 hr. extension and transfer, *or* approved inter-university cooperative program.

### **Counseling and Guidance (Doctoral Degree—Ed.D.)**

The doctoral degree program in Counseling and Guidance is tailored to individual needs; however, it does require extensive academic and practical work which carries the student beyond the minimum limits established in the College requirements for the Ed.D. degree. The one-year minimum residency requirement and minimum hour requirements are typically insufficient to master the competencies in knowledge, application of techniques, and research skills. Contact with the program area should be initiated before formal application.

As in the master's degree and certificate of advanced study programs, students may concentrate their program of study in the general area of student personnel work in higher education. Appropriate course work specifically geared to the field is available in the program area, in the Division of Education, and in the College of Commerce. For program requirements write the C&G Office, 504 Forestry Tower; an interview is required for admission.

### **Counseling and Guidance**

#### **C&G**

216. **Behavior Problems and the School.** I, II, S. 3 hr. Emphasis on the identification and understanding of students with special needs in the areas of social, emotional, and learning problems and in developing remedial programs for these students leading to more satisfactory adjustment within the school situation.
283. **Workshop in Counseling and Guidance.** I, II, S. 1-12 hr. PR: Consent. To take care of credits for special workshops and short intensive limit courses on methods, supervision and other special topics.
302. **Human Relationships.** I, II, S. 2-3 hr. Didactic content and experience in group processes providing self-screening for prospective counselors. One-half time devoted to class discussion and one-half to sensitivity groups.
303. **Basic Course in Guidance.** I, II, S. 3 hr. An overview of a total guidance program covering the philosophical, sociological, and psychological foundations of a counseling program, and study of the major theories of vocational choice.
304. (or Rehab. 304). **Vocational Development and Occupational Choices.** I, II, S. 2-4 hr. PR: C&G 303. Methods of gathering and disseminating occupational and educational information.
305. **Theory and Practice of Human Appraisal.** I, II, S. 3 hr. PR: C&G 303 or proficiency in statistics and consent. Comprehensive study of all objective measures used in schools; techniques of administering and interpreting tests to individual and groups; developing testing programs and costs.
306. **Counseling Theory and Techniques.** I, II, S. 3 hr. PR: C&G 303, 304, 305. Seminar study of counseling techniques with coverage of major classical and contemporary theories,

307. **Application of Counseling Techniques.** I, II, S. 3 hr. PR: C&G 303, 304, 305, 306. Clinical consideration of identification, causes and development of psychological maladjustments, further study of developments in counseling with role play and counseling under supervision.
308. **Organization and Development of Counseling and Guidance Services.** II, S. 2 hr. PR: C&G 303, 304, 305, 306. Operation of guidance program in terms of personal functions, relationships, physical facilities, instructional integration, financial standards, law and regulations.
309. **Group Counseling Theory and Techniques.** II, S. 2-3 hr. PR: C&G 306, 307. A comprehensive coverage of theories of group counseling and demonstrations of specific group techniques for advanced Master's and Certificate of Advanced Studies candidates in Counseling and Guidance.
310. **Introduction to Student Personnel Work in Higher Education.** I. 3 hr. PR: Consent. A historical and topical study of the development of student personnel structure and functions in higher education, including an examination of goals and objectives in light of current social forces and relevant research.
330. **Elementary School Guidance.** I, S. 3 hr. PR: Consent. Practical application of the principles of guidance to the elementary school.
382. **Special Topics.** I, II, S. 1-6 hr. PR: Advanced standing and consent. Independent study and directed readings in specialized areas of counseling and guidance.
385. **Practicum.** I, II, S. 1-12 hr. PR: Preregistration, cleared for graduation at close of term, or M.A. degree. An intensive supervised practical experience in the public schools in counseling with individual critique and appropriate small group experiences.
395. **Problem in Counseling and Guidance.** I, II, S. 1-12 hr. PR: Consent. Study and research for master's degree in Counseling and Guidance.
431. **Practice of Elementary School Counseling and Guidance.** I, II, S. 4 hr. PR: C&G 330 and consent. A specialized multiple training experience covering advanced theory, techniques and practices, skill development in teacher consulting, analysis of classroom climate, and competence to deal with the typical problems encountered by the counselor in the elementary school.
463. **Advanced Theories of Counseling.** I, S. 3 hr. PR: Practicum in counseling, admission to advanced graduate study, and consent. A comprehensive study of the theoretical issues in contemporary counseling.
464. **Individual Intelligence Testing and Interpretation.** I. 4 hr. PR: Advanced graduate standing and preregistration with instructor (9 hr. psychology and demonstration of proficiency in measurement needed for admission). Techniques in administering, scoring, and interpreting individual mental ability tests.
466. **Manpower Utilization and Development.** II. 3 hr. PR: Advanced standing and consent. A consideration of the economic, social, and political implications of manpower utilization and the role the counselor must undertake to assist society with its ever pressing demands.
469. **Advanced Theory and Practice of Human Appraisal.** II, S. 3 hr. PR: Statistics 311, C&G 375, and consent. Analysis of and supervised practice in the use of major standardized and local assessment instruments typically used in vocational and educational guidance and counseling. Included also are factors in the management and development of coherent testing programs.
472. **Internship in Student Personnel Work.** I, II. 1-12 hr. PR: C&G 310 and admission to Certificate of Advanced Studies or Doctoral program in Counseling and Guidance. The course is designed to offer advanced graduate students an opportunity to practice under close supervision the professional skills required in the broad field of student personnel work in higher education.

480. **Seminar.** I, II, S. 1-6 hr. PR: Advanced graduate standing and consent. Seminar for Certificate of Advanced Studies and doctoral students in Counseling and Guidance.
497. **Research.** I, II, S. 1-15 hr.

## Reading

Graduate students with successful teaching experience at the elementary, secondary, or college levels may wish to increase their competence as teachers of reading, keep abreast with latest trends and developments in the field of reading, or advance to positions of greater responsibility. To meet the needs of such students, the Department of Reading offers graduate programs leading to certification of Reading Specialists, a Master of Arts degree in reading, a post-master Certificate of Advanced Study, and the Doctor of Education degree with a major in reading.

Course offerings provide opportunities to become familiar with the organization, implementation, and administration of developmental and remedial reading programs for students at the elementary and secondary levels. Advanced students of superior academic and professional background find in the doctoral program opportunities to participate in clinical programs, to become involved in research, and to prepare for positions in public and private schools at elementary, secondary, and college levels.

Programs for graduate study are worked out individually with each student. Course requirements depend upon previous academic background and experience and the position for which the student wishes to prepare.

## Certification in Reading

Two licenses for teaching reading are available to West Virginia teachers: a temporary endorsement and an endorsement as a Reading Specialist.

*Temporary Endorsement.* Nine (9) semester hours of graduate credit in reading courses are needed for temporary endorsement as a reading teacher. The areas of concentration and approved courses are:

Foundations of Reading Instruction—(3 hr.): Rdng. 321—Reading for Classroom Teachers; Rdng. 322—Reading Instruction in Secondary Schools; and Rdng. 324—Psychological Foundations of Reading Instruction.

Diagnosis and Correction of Reading Difficulties—(3 hr.): Rdng. 283—Workshop: Remedial Reading (Extension Course); and Rdng. 340—Corrective Techniques in Reading Instruction.

Clinical Reading—(3 hr.): Rdng. 341—Problems in Clinical Reading; and Rdng. 444—Advanced Clinical Reading.

*Reading Specialist Endorsement.* Twenty-seven (27) semester hours of graduate credit are needed for a Reading Specialist endorsement—fifteen (15) semester hours with credit in each area named in Group A, and twelve (12) semester hours with credit in each area named in Group B. The areas of concentration and approved courses:



## I. *Course Requirements*

### Group A (15 semester hours)

Foundations of Reading Instruction (6 hr.)

Rdng. 321—Reading for Classroom Teachers *or*

Rdng. 322—Reading Instruction in Secondary Schools

Rdng. 324—Psychological Foundations of Reading Instruction

Diagnosis and Correction of Reading Difficulties (3 hr.)

Rdng. 283—Workshop: Remedial Reading (Extension Course)

Rdng. 340—Corrective Techniques in Reading Instruction

Rdng. 442—Diagnosis of Reading Difficulties

Rdng. 443—Correction of Reading Difficulties

Clinical Reading (Laboratory Experiences) (3 hr.)

Rdng. 341—Problems in Clinical Reading

Rdng. 444—Advanced Clinical Reading

Planning and Organizing a Reading Program (3 hr.)

Rdng. 283—Workshop: Organizing the Reading Program

Rdng. 326—The Organization, Administration, and Supervision of the Reading Program

### Group B (12 semester hours)

Measurement and/or Evaluation (3 hr.)

Ed. Psych. 330—Educational Measurements

Ed. Psych. 395—Practicum Educational Measurements

Human Development (3 hr.)

Psych. 243—Child Behavior

Psych. 282—Exceptional Children

Ed. Psych. 440—Human Development and Behavior

C&G 216—Behavior Problems in the School

Psychology of Personality and/or Mental Hygiene (3 hr.)

Psych. 281—Abnormal Psychology

Psych. 263—Introduction to Personality

Psych. 264—Psychology of Adjustment

C&G 302—Human Relationships

C&G 305—Theory and Practices of Human Appraisal

Educational Psychology (3 hr.)

Ed. Psych. 270—Workshop in Advanced Educational Psychology

Ed. Psych. 370—Principles of Instruction

Ed. Psych. 450—Psychological Foundations of Learning

Psych. 423—Human Learning

## II. *Additional Requirements\**

A. A valid professional teaching certificate or its equivalent

B. Three years of successful experience as a classroom teacher

C. A master's degree in reading or classroom teaching

D. Recommendation of the College for a Reading Specialist Certification

\*Students who desire reading certification in states other than West Virginia should consult with their adviser relative to requirements.

## Master of Arts Degree (Reading)

### I. Admission to Program

- A. Accepted to graduate study by the Office of Admissions, West Virginia University
- B. Minimum 2.5 undergraduate grade-point average, or a minimum Graduate Record Aptitude Examination score of 400 (verbal)
- C. Contact with Department of Reading by mail or conference prior to registration for courses
- D. Applicants who do not meet the above criteria may be given probationary admission
- E. Students must complete six or more hours in reading within two years after admission (probationary or regular) or admission will be invalidated and the student will be required to reapply.

### II. Admission to Candidacy

- A. Admission to program as regular graduate student
- B. Completion of 12 hours of course work, 9 of which must be taken on campus
- C. A grade-point average of 3.0 or better in the above 12 hours of course work.
- D. Proof of successful teaching experience beyond student teaching or practicum experience in the public school.

### III. Program Requirements

- A. Program A—Completion of a minimum of 36 hours (21 required and 15 elective hours in reading or in subjects related to reading).
- B. Program B—Completion of 30 hours including a 3-hour problem or a 6-hour thesis.
- C. Credit limitations
  - 1. No more than 12 hours of graduate credit obtained at other approved institutions may be considered for transfer.
  - 2. No more than 15 hours of extension credit or combination of extension and transfer credit may be counted toward the Master's Degree.
  - 3. No more than nine hours in extension may be obtained before completing at least six hours on campus.
  - 4. No more than 6 hours of the required 12 hours of reading courses may be completed in extension.
  - 5. Written approval from the adviser is necessary before transfer credit can be counted.
- D. Successful experience as a classroom teacher or a practicum experience in public schools.
- E. A minimum grade-point average of 3.0.
- F. Successful completion of the written and/or oral Master's Comprehensive Examination.

#### IV. Course Requirements

A. Required Courses		Program	A	B
Ed. Psych. 330°	.....		3	3
Ed. Psych. 320°	.....		3	0
Ed. 301 or 304	.....		0	3
Ed. 280°	.....		0	3
Rdng. 321° or 322°	.....		3	3
Rdng. 324°	.....		3	3
Rdng. 340°	.....		3	3
Rdng. 341°	.....		3	3
Rdng. 495	.....		3	0
			<hr/>	<hr/>
			21	21
B. Electives .....			9	15
Rdng. 283, 330, 325, 326, ° 442, 443				
Psych. 243, ° 263, ° 264, 282, 423				
Ed. Psych. 440, 450°				
C&G 216, 302, 305, 303				
SP 275				
SPA 250				
Sp. Ed. 255, 260, 306, 480				
			<hr/>	<hr/>
Total .....			30	36

°Courses marked with an asterisk (or their equivalent) are required for an endorsement as a Reading Specialist in West Virginia. They can be replaced by a transfer or substitute course only by written permission from the adviser.

Completion of this curriculum fulfills the course requirements for a Master's Degree in Reading at WVU.

#### Certificate of Advanced Study in Reading

The program for the Certificate of Advanced Study in Reading is designed to develop individuals who possess advanced knowledge and professional skill in the language arts area and who can and will assume leadership positions in educational systems.

##### I. General Requirements

- Complete the general requirements for admission to the Graduate School of West Virginia University.
- Present, at the time of application, proof of a Master's Degree from an accredited university.
- Have a minimum grade-point average of 3.0 on all work completed for the Master's degree.
- Verify the completion of a minimum of three years of teaching or related experiences.



- E. Plan, with the aid of a CAS committee, a total program of 30 graduate credits including a 6-hour research project.
- F. Complete a residency requirement of eighteen semester hours.
- G. Meet all requirements for a Reading Specialist Certificate.
- H. Maintain an average of 3.0 or above on all course work.
- I. Pass an oral examination on the research project and on all courses taken in Reading.
- J. Meet all the above requirements within the *five* calendar years immediately preceding the award of the Certificate of Advanced Study.

II. <i>Course Requirements (30 hours)</i>	<i>Hr.</i>
A. <i>Reading (selected from the following)</i> .....	15
Rdng. 325—Survey of Major Problems in Reading .....	3
Rdng. 332—Survey of Major Prob. in the Language Arts .....	3
Rdng. 442—Diagnosis of Reading Difficulties .....	3
Rdng. 443—Correction of Reading Difficulties .....	3
Rdng. 444—Advanced Clinical Reading .....	3
Rdng. 480—Seminar .....	3
Rdng. 481—Special Topics .....	1- 6
Rdng. 485—Practicum .....	1-12
Rdng. 497—Research (6 hours required) .....	1-15
B. <i>Electives (reading or related courses)</i> .....	9
Selected by adviser and student to meet individual needs.	

Reading majors at the CAS level who have not completed prerequisites for the courses selected should plan to do so as additional academic requirements for the degree *unless the courses are waived*. Prerequisites may be waived by joint consent of the adviser and Coordinator of the Reading Center if in their opinion the student has had background experiences in reading which are equivalent to those provided by the courses listed in the catalog as prerequisites.

## The Degree of Doctor of Education (Reading)

The doctoral program in Reading is highly individualized. As such, the reading curriculum for a concentration at the doctoral level cannot be prepared in advance. Courses will depend upon the student's background, experience, courses completed at the Master's level, and the post-doctoral objectives of the individual. Reading courses to be completed at another institution must receive prior approval by the student's doctoral committee.

Students who desire to complete the Doctor of Education degree with a concentration in reading must meet the following standards:

1. Complete all graduate school and college requirements for admission to graduate study at the doctoral level.
2. Pass the preliminary examination for entrance into the doctoral program.
3. Plan, with the aid of the Doctoral Committee, a satisfactory program with a minimum of 24 semester hours in reading.
4. Complete a residency requirement of at least one academic year. (18 semester hours)

5. Pass the Admission to Candidacy Examination satisfactorily.
6. Maintain an average of 3.0 or above on all course work.
7. Prepare a suitable dissertation on some phase of reading or language arts.
8. Pass the final oral examination successfully.
9. Present suitably printed copies of the dissertation to the Chairman of his Doctoral Committee, to the Graduate School, and to other University agencies which might require copies.

## Reading

### Rdng.

283. **Special Workshop in Reading.** I, II, S. 1-6 hr. A course designed for in-service training of teachers—both elementary and secondary. Regularly offered as an extension course, the chief emphasis is upon the organization of reading programs in the elementary and secondary schools.
321. **Reading for Classroom Teachers.** I, II, S. 3 hr. PR: Consent. A basic course in teaching reading, grades 1-12. It is planned to give students who have little or no background in reading an opportunity to study the reading process and to learn how to apply effective techniques and methods to classroom teaching of reading.
322. **Reading Instruction in the Secondary Schools.** I, II, S. 3 hr. PR: Consent. A study of the reading skills essential at the high school level and how they may be developed in the various subject matter areas.
324. **Psychological Foundations of Reading Instruction.** I, S. 3 hr. A course which is principally concerned with the physiological, psychological, and sociological factors underlying the development of reading skills. The course is intended for majors in education, reading, guidance, special education, speech, and other areas whose specialties require an understanding of the reading process.
325. **Survey of Major Problems in Reading.** II, S. 3 hr. PR: Rdng. 321, 322, or 324. An advanced course in the major problems confronting the teacher or supervisor of reading instruction. Essentially a research course in which each student will have the opportunity to complete an individual problem in an area of special interest.
326. **The Organization, Administration, and Supervision of the Reading Program.** I, II, S. 3 hr. Stresses current practices and procedures in organizing reading programs in all types of schools, grade 1 through college.
330. **Teaching the Language Arts.** I, S. 3 hr. PR: Consent. A study of the inter-relationship among the different phases of the language arts. Special attention is given to organizing the language arts program, selecting materials and equipment, and understanding effective techniques and methods for teaching listening, oral language, written language, handwriting, and spelling.
331. **Selection and Evaluation of Reading Materials.** I, S. 3 hr. PR: Consent. A survey of critical reading skills, techniques, and procedures with emphasis on the selection of supplementary materials needed for effective developmental and remedial reading programs.
332. **Survey of Major Problems in the Language Arts.** II, S. 3 hr. PR: Rdng. 330 or consent. An advanced course covering the major problems confronting the teacher or supervisor of language arts instructor. Essentially a research course in which each student will complete an individual problem in an area of special interest.
340. **Corrective Techniques in Reading Instruction.** I, II, S. 3 hr. PR: Rdng. 321, 322, 324. A basic course in corrective reading for classroom teachers. Special

emphasis is given to the correction of reading difficulties by classroom teachers with equipment and materials available to the average classroom.

- 341. **Problems in Clinical Reading.** I, II, S. 3 hr. PR: Rdng. 340. A laboratory course in remedial reading. Major emphasis will be placed upon tutoring remedial cases in the Reading Center.
- 442. **Diagnosis of Reading Difficulties.** I, S. 3 hr. PR: Rdng. 340. Advanced instruction in diagnosis. Emphasis will be placed upon the use of standardization tests, informal tests, machines, and observation in determining the cause of reading difficulties.
- 443. **Correction of Reading Difficulties.** II, S. 3 hr. PR: Rdng. 442 or consent. Advanced instruction in the correction of reading difficulties. Major emphasis will be placed upon methods of teaching, the use of machines and commercial materials, constructing and using teacher-made exercises, and evaluating progress.
- 444. **Advanced Clinical Reading.** I, II, S. 3 hr. PR: Rdng. 341. An advanced laboratory course in remedial reading. Major emphasis will be placed upon the diagnosis and treatment of reading difficulties caused by specific learning disabilities.
- 480. **Seminar.** I, II, S. 1-6 hr. PR: Consent. A seminar stressing the interrelationships among the language arts; mental, physical, and psychological deterrents to language development; needed research in languages arts; and similar topics.
- 481. **Special Topics.** I, II, S. 1-6 hr. PR: Admission to the doctoral program in reading and consent. An advanced seminar for doctoral students. Considers the weaknesses and strengths in current reading programs, needed research in reading, and suggestions for improving reading instruction at the elementary, secondary, and college levels.
- 485. **Practicum.** I, II, S. 1-12 hr. PR: Consent. Stresses practical application of reading theory to organizing and conducting developmental and remedial reading programs.
- 495. **Problem in Reading.** I, II, S. 3 hr. Research for Master's degree in Reading.
- 497. **Research.** I, II, S. 1-15 hr.

## **Rehabilitation Counseling**

The program in Rehabilitation Counseling offers a graduate curriculum designed to prepare professional counselors to work in a wide variety of rehabilitation settings, including public and private rehabilitation agencies, rehabilitation centers, sheltered workshops, hospitals, and similar facilities. The program prepares the counselor to contribute effectively as a member of a professional team through his understanding of human behavior, his knowledge of rehabilitation concepts, his utilization of effective counseling, and a knowledge and application of rehabilitation evaluation techniques. The counselor must also have developed skill in coordinating services to meet the needs of handicapped persons.

## **Admission**

The applicant must meet admission requirements of the Graduate School and the Program Admissions Committee. A broad liberal arts background is preferable; however, an applicant must have earned a minimum of 6-9 semester hours in courses related to the dynamics of human behavior as a pre-



requisite to unconditional acceptance as a full-time degree candidate. In addition, each applicant must successfully complete personal interviews with the program faculty and achieve acceptable scores on the program entrance examination.

### **Requirements for Completion**

The degree of Master of Science with a major in Rehabilitation Counseling is conferred by the University upon those students who satisfactorily complete the requirements established by the Graduate School, including the following requirements:

1. Completion of graduate courses approved by the Rehabilitation Counseling Program totaling no fewer than 42 semester hours with a 3.0 grade-point average. In most cases, the total program will range between 42 and 48 semester hours.

2. Completion of 10 to 12 semester hours of supervised clinical practice under faculty direction in a rehabilitation setting.

3. Demonstration of competence in the theoretical and applied aspects of rehabilitation counseling to the satisfaction of the Faculty Committee in charge of the program. This will include passing a comprehensive examination, oral, written, or both, at the discretion of the Committee. A project will be required. A degree will not be awarded solely on the basis of credits earned. A candidate must also demonstrate, as he proceeds in the program, the ability to assume the degree of responsibility required of a professional counselor, and the personal characteristics essential to effective working relationships with others.

### **Curriculum**

The choice of courses comprising the program will be determined by an evaluation of the needs of the individual student. The student's program is then supplemented by other courses offered in Rehabilitation or by appropriate electives selected from other programs and departments. In all cases, courses are selected by the student with the consent of his adviser.

#### **Rehabilitation Counseling**

##### **Rehab. Counsel.**

300. **Introduction to Rehabilitation Services.** I, II. 2 hr. PR: Junior standing and 15 hr. in social science or education or consent. A study of the processes by which certain human conditions may be ameliorated by social and vocational rehabilitation services, in particular, counseling and evaluation. Emphasis upon historical survey, philosophy and concepts of rehabilitation and case service techniques to assist individuals with physical, mental, and/or social handicaps.
310. **Medical Aspects of Rehabilitation.** I, II. 3 hr. PR: Junior standing and 15 hours in social science or education or consent. A study of the medical needs of handicapped persons in the rehabilitation process from time of referral through placement and case closure.
312. **Psychological Aspects of Disability.** I, II. 3 hr. PR: Graduate standing and consent. A study of the psychodynamics of adjustment to atypical physique and prolonged infirmity. Includes a study of somatopsychology.

- 314. **Special Problems in Rehabilitation.** I, II. 1-3 hr. PR: Graduate standing and consent. Rehabilitation theory and techniques in problems such as blindness, epilepsy, and mental retardation. Course also provides for concentrated study in special institutes.
- 320. **Vocational Development and Occupational Choices.** I, II. 3 hr. PR: Graduate standing in social sciences or education. A study of vocational development theory, occupational choice, problems of maturation and work attitudes, techniques of job evaluation, and socio-economic implications of a changing occupational structure.
- 374. **Field Work in Rehabilitation.** I, II, S. 1-6 hr. PR: Consent. Supervised field work experience in rehabilitation settings to provide rehabilitation counseling students with a more adequate orientation to their profession.
- 462. **Clinical Conference in Rehabilitation.** I, II, S. 3 hr. PR: Graduate standing and consent. An analysis and integration of the clinical methods essential to facilitating the rehabilitation process.
- 472. **Counseling Practicum.** I, II. 3 hr. PR: Graduate standing and consent. Supervised experience in the application of counseling techniques in the rehabilitation process.
- 475. **Clinical Practice.** I, II, S. 1-12 hr. PR: Consent, following at least one academic semester in classroom. Clinical practice (internship) in selected agencies, rehabilitation centers, clinics, or hospitals conducting an organized program of services for the physically, mentally, emotionally, or socially handicapped. Such practice will be under direct supervision of faculty and agency personnel.
- 480. **Seminar.** I, II, S. 1-12 hr. PR: Consent. Administration of programmatic research; legal and ethical issues in research and service programs, etc.
- 481. **Special Topics.** I, II, S. 1-6 hr. PR: Consent. Contemporary issues in the behavioral sciences and rehabilitation.
- 482. **Workshop in Rehabilitation.** I, II, S. 1-12 hr. PR: Consent. Supervision in the counseling process; vocational evaluation in rehabilitation; utilization of rehabilitation research; contemporary issues in rehabilitation.
- 497. **Research.** I, II, S. 1-15 hr.

Special Education

Curriculum for Special Education

Degree: Master of Arts

I. Required Courses	Program <sup>1</sup>	A	B	C
Sp. Ed. 250		3	3	3
Sp. Ed. 255		3	3	3
Sp. Ed. 260		0	3	3
Sp. Ed. 305		0	0	3
Sp. Ed. 306		0	0	3
Sp. Ed. 380		3	3	0
Sp. Ed. 487		0	0	3-6
Sp. Ed. 395		0	3	0
Sp. Ed. 497		6	0	0
C&G 305		0	0	3
Psych. 281		0	0	3
SPA 250		0	0	3
Stat. 311 or Ed. Psych. 320		3	3	0
Stat. 312		3	0	0
Total		21	18	27-30

	Program A	B	C
II. Approved Electives	15	18	9-6
C&G 303, 305, 306, 330, 464, 466.			
C & I 301, 304, 330, 438.			
Ed. Found. 320.			
Ed. Psych. 260, 320, 330, 343, 440, 450, 451.			
P.E. 276.			
Psych. 263, 264, 271, 282, 423.			
Rdng. 321, 324, 325, 340.			
Rehab. Counsel. 300, 388.			
SPA 250.			
Sp. Ed. 250, 255, 260, 262, 265, 280, 281, 305, 306, 365, 381, 395, 480, 487, 496.			
Stat. 311, 312.			
Total for Master's Degree	36	36	36

<sup>1</sup>A—Thesis Program  
B—Problem Program  
C—Teaching Certification Program

## Special Education

### Sp. Ed.

250. **Survey of Exceptional Children and Adults.** I, II, S. 3 hr. PR: Consent. Introduction to all areas of exceptionality. Topics surveyed include definition, psychological and educational characteristics, and social and vocational adjustment.
255. **Introduction to Mental Retardation.** I, II, S. 3 hr. PR: Consent. Consideration of historical, etiological, social, educational, and vocational aspects of mental retardation.
260. **Curriculum and Methods for the Educable Mentally Retarded.** I, II, S. 3 hr. PR: Sp. Ed. 250, 255 and/or consent. Organization of instruction, adaptation of teaching methods in the several curricula areas and the construction of materials.
262. **Curriculum and Methods for the Trainable Mentally Retarded.** I, II, S. 3 hr. PR: Sp. Ed. 250, 255 and/or consent. Analysis of special problems of curriculum development for the trainable child and adult and provisions for development of original construction of curricula materials.
265. **Industrial Arts in Special Education.** II, S. 3 hr. Experimentation with industrial arts and crafts suitable for instruction in special education classes. Discussion of factors involved in selection and manipulation of such media as leather, plastics, ceramics, wood, and metal.
271. **Curriculum, Materials, and Methods for Mentally Gifted.** I, II, S. 3 hr. History and philosophy, identification, curriculum, materials and methods of working with mentally gifted.
280. **Student Teaching Clinical Experience in Special Education.** I, II, S. 1-6 hr. PR: Consent. Student teaching with the mentally retarded.
281. **Special Problems and Workshop in Special Education.** I, II, S. 2-4 hr. PR: Consent. To take care of credits for special workshops and short intensive unit course on methods, supervision, and other special topics.
305. **Mathematics for the Mentally Retarded.** I, S. 3 hr. PR: Consent. Materials and methods for teaching mathematics to the mentally retarded child.
306. **Reading for Mentally Retarded Children.** I, S. 3 hr. Designed especially for majors in Special Education. Emphasizes the techniques, methods, and materials most effective for teaching reading to mentally retarded.



365. **Administration and Supervision of Programs for Exceptional Children.** I, II, S. 3 hr. PR: Consent. Administration and supervision with attention to: selection and placement procedures; facilities and equipment; local, state, federal legislation; and philosophy and recent research.
381. **Special Topics.** I, II, S. 1-6 hr. PR: Consent. Special topics or research in mental retardation and in exceptional children and adults.
395. **Problem in Special Education.** I, II, S. 3 hr. Research for Master's Degree in Special Education.
480. **Seminar.** I, II, S. 1-6 hr. PR: Consent. Special topics concerned with the educational, sociological, and psychological aspects of mental retardation.
487. **Practicum.** I, II, S. 1-12 hr. PR: Consent. Internship, advanced student teaching, and administration and supervision practicum.
496. **Project in Special Education.** I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Special Education.
497. **Research.** I, II, S. 1-15 hr.

## **Speech Pathology and Audiology**

### **Master of Science in Speech Pathology and Audiology**

Applicants who possess a Bachelor's degree from an accredited college or university may be admitted to a program leading to candidacy for the degree of Master of Science in Speech Pathology and Audiology, provided that they:

1. Present evidence of ability to pursue graduate work successfully as measured by Graduate School and Divisional standards for admission.
2. Attain an overall grade-point average of 2.75 or above on a 4.0 scale at the undergraduate level as evidenced by an official transcript. This transcript must be made available to the Office of Admissions and the Speech Pathology-Audiology Graduate Student Acceptance Committee. Any deficiencies in undergraduate preparation will be made up either without credit or for additional credit required for the Master of Science degree.
3. Provide evidence of the personal qualities predictive of professional success through written letters of recommendation by three individuals in the academic community. These letters must be submitted to the Office of Admissions with copies to the Speech Pathology-Audiology Graduate Student Acceptance Committee.

Deadlines for submitting applications and the material requested in items 1-3 are March 1 for the summer and fall semesters and November 1 for the spring semester. No student will be accepted on a provisional or probationary basis.

Of the applicants under consideration, the Speech Pathology-Audiology Graduate Student Acceptance Committee will accept those who they believe will meet with success in the graduate program. The number of applicants accepted will depend upon the number of qualified applicants, the size of the Speech Pathology-Audiology graduate faculty, and the facilities available for acceptable academic, clinical, and research training.

Once the student has taken 15 academic hours of Speech Pathology-Audiology graduate courses, his academic and professional performance will be evaluated by the Speech Pathology-Audiology faculty. If his academic average

is below 3.0 or if he has more than five semester hours of C or below, he will be dismissed from the program with no probationary status.

Requirements for completion of the Master of Science degree in Speech Pathology-Audiology are:

1. A minimum of 36 semester hours of approved graduate courses in speech and hearing sciences, speech pathology, audiology, and other related areas as may be required to attain professional competence. The student may elect to take up to 6 semester hours of thesis credit in attaining the 36-hour minimum. The student must achieve not less than a 3.0 average for all courses taken for credit toward the graduate degree.

2. Successful performance on written and oral comprehensive examinations according to Graduate School and Divisional standards.

3. Demonstration of professional competence in speech and/or hearing as measured by fulfillment of the academic and practical requirements established by the faculty.

### **Doctor of Education in Speech Pathology and Audiology**

Placed under temporary moratorium by the Program Faculty for an indefinite period, effective January 1, 1968.

#### **Speech Pathology and Audiology**

##### **SPA**

- 220. **Introduction to Audiology. I.** 4 hr. PR: Consent. A study of the gross anatomy and physiology of the auditory mechanism; the physics of acoustic signal production; and an introduction to basic audiometric techniques and interpretation.
- 222. **Hearing Conservation. I.** 2 hr. PR: SPA 220 or consent. An investigation of trauma (varied) on auditory sensitivity and acuity; identification audiometry; and approaches to hearing conservation.
- 223. **Aural Rehabilitation. II.** 3 hr. PR: SPA 220 or consent. A survey of the rehabilitative approaches to management in the auditorially handicapped individual. The medical, audiological and social aspects of rehabilitation will be stressed. Procedures of speech reading and auditory training will be examined and evaluated.
- 250. **Survey of Oral Communication Disorders. II.** 3 hr. PR: Consent. A survey of basic concepts and principles of the disorders of speech and their treatment. Primary attention is given to the more common speech deviations. Students observe examination and corrective methods of therapists in the clinic and schools. Normal speech and hearing development of children is considered. This is an orientation course for students majoring in speech as well as teachers, school administrators, psychologists, and rehabilitation workers.
- 251. **Advanced Speech Correction. II.** 3 hr. PR: SPA 156. Study of the speech-retarded child and organically based speech disorders including cleft palate, cerebral palsy, esophageal speech, and phonation.
- 252. **Stuttering. I.** 3 hr. PR: SPA 156. Theories and therapies of stuttering.
- 253. **Profound Organic Speech Disorders. II.** 3 hr. PR: SPA 251 or consent. Speech and language disorders related to cerebral injury. Emphasis on aphasia and aphasia therapeutics. Differential diagnosis of children with delayed speech and language.

281. **Special Topics. I, II, S.** 1-3 hr. per sem. (Max. credit 6 hr.). Independent study of topics in speech pathology, audiology, and speech and hearing sciences.
282. **Clinical Practice in Speech. I, II.** 1-6 hr. PR: Consent. Supervised diagnosis and therapy of speech disorders. (May be taken for a maximum of 3 semester hours per semester of undergraduate or graduate credit.)
283. **Clinical Practice in Hearing. I, II.** 1-6 hr. PR: Consent. Supervised diagnosis and therapy of hearing disorders. (May be taken for a maximum of 3 semester hours per semester of undergraduate or graduate credit.)
321. **Structure and Function of the Auditory System. I.** 3 hr. PR: Consent. A detailed study of the gross and microscopic anatomy of the auditory system, and a detailed investigation of the physiological aspects of auditory sensitivity and acuity.
322. **Audiology and Audiometry. I.** 3 hr. PR: SPA 220 or equiv. A study of the various audiological techniques that are utilized in the differential diagnosis of auditory dysfunctioning. Administration and interpretation of diagnostic techniques.
323. **Bone Conduction Audiometry. II.** 3 hr. PR: SPA 321, 322. An advanced consideration of the anatomical and physiological mechanisms involved in the transmission of acoustic signals through the skull, and the audiological problems in clinical bone conduction audiometry.
324. **Speech Audiometry. I.** 3 hr. PR: SPA 321, 322. The basis for the application of hearing for speech tests in assessing communication systems. Analysis of auditory processing of complex signals and the role of complex signal processing in the differential diagnosis of auditory dysfunction.
325. **Hearing Aids. II.** 3 hr. PR: SPA 322. Principles of the electronic design of amplification systems and acoustic analysis of amplification systems. Hearing aid evaluation procedures.
328. **Clinical Administration Audiology. I.** 3 hr. PR: Consent. The examination of the procedures for initiating and maintaining audiological services in the medical, public school, and community clinical environments.
329. **Acoustic Instrumentation. II.** 3 hr. PR: SPA 158, 322. Principles of electronic design utilized in clinical auditory testing and amplification. Evaluation and assessment of hearing aids in aural rehabilitation.
340. **Experimental Phonetics. II.** 3 hr. PR: SPA 153 and consent. Investigation of problems of phonetics as they are related to functional speech. Instruments used in sound analysis and an investigation of various aspects of architectural acoustics.
341. **Problems in Speech Pathology. I.** 3 hr. PR: Consent. The speech pathologist as a diagnostician and therapist in interdisciplinary investigations. Examination of counseling procedures, administrative practices in varied settings, and organization of programs of various pathologies of speech.
342. **Advanced Speech Pathology. II.** 3 hr. PR: SPA 251 and consent. Theories of causation and therapies for delayed language development, cleft palate, and cerebral palsy.
343. **Neuropathologies of Speech and Language. I.** 3 hr. PR: SPA 154, 253, or consent. Speech and language disturbances related to brain injury or maldevelopment. Consideration of the neurological bases, pathologies and psychological factors involved in the loss or lack of development of speech and language.
380. **Seminar: Audiology. I.** 1-6 hr. PR: SPA 158, 322. Topics vary from term to term to meet student needs. Suggested topics: aural rehabilitation, medical audiology, audiological research, etc.
383. **Clinical Practice in Audiology. I, II.** 1-6 hr. PR: SPA 220 or equiv. and SPA 383 may be taken in conjunction with SPA 322. Supervised experience in the



administration and interpretation of audiological evaluative procedures, and application of therapeutic techniques in aural rehabilitation.

387. **Special Topics. I, II.** 1-6 hr. PR: Consent. Open to graduate students in speech pathology and audiology who are pursuing independent problems in that field. May be repeated.
497. **Research. I, II.** 1-15 hr.

## **DIVISION OF EDUCATION**

The Division of Education is comprised of resident courses of instruction and facilities for research; University High School with its opportunities for observing, student teaching, directed supervision, and experimentation; and co-operating elementary and secondary schools for supervised student-teaching experience.

Programs are accredited by the National Council for Accreditation of Teacher Education for the preparation of elementary teachers, secondary teachers, school service personnel, and school administrators, with the Doctor's degree as the highest degree approved.

### **Master of Arts**

#### **Requirements for Admission to Graduate Work in Education**

It is the responsibility of all applicants for admission and all candidates for graduate degrees and certificates to conform to the general regulations of the Graduate School.

#### **Requirements for Admission to Candidacy for the Master's Degree in Education**

Graduate students apply to the Office of Admissions for admission. Scores on the Aptitude Test of the Graduate Record Examination should accompany the application but must, in all cases, be submitted to the Division of Education prior to completion of the first 15 semester hours of graduate study. Students may take no more than 9 semester hours in extension prior to completion of at least 6 semester hours in residence. Conditions of Admission to the master's degree program in education follow.

For admission to candidacy for the Master's Degree in Education, students must have a professional teaching certificate based upon an approved teacher education program or at least 20 semester hours of approved undergraduate credit in education.

Students may be admitted as degree candidates on submission of a minimum composite score of 950 on the Aptitude Test of the Graduate Record Examination, *or* an undergraduate grade-point average of 2.5 (based on a 4.0-point system). These students may pursue the program of their choice immediately.

Students who do not meet either of the above admission requirements may take a maximum of 15 semester hours of course work. At the end of this period students may apply to the Committee on Admissions for review of their admissions classification. Re-classification will be considered *only* in cases in which the student has achieved a *minimum* grade-point average of 3.0 for the first 15 semester hours of graduate study. All work taken up to the conclusion

of the term in which the fifteenth semester hour is earned will be used in computing the grade-point average. If the student is not reclassified to degree program status by the Committee on Admissions, he is not eligible to continue graduate study in the Division of Education. He may, upon petition to the Director of the Division of Education, be permitted to take additional course work for the renewal of his teaching certificate.

#### **Optional Routes Towards a Master's Degree in Education**

A. Thirty semester hours, including 6 semester hours of research. Examination (oral, written, or both, at the discretion of the candidate's advisory committee.);

B. Thirty semester hours, including 3 semester hours of research, selected in conference with the candidate's committee, directed by the adviser, with final approval by the committee and 27 semester hours of course work Examination (oral, written, or both, at the discretion of the candidate's advisory committee.);

C. Thirty-six semester hours, including 15 semester hours of course work. Examination (oral, written, or both, at the discretion of the candidate's advisory committee.); and

D. Program options D and E are offered in several programs.

#### **Special Requirements for the Master's Degree in Education**

1. No student may be awarded a Master's degree in Education unless the student has a minimum grade-point average of 2.5 on all work taken for graduate credit. (A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.)

2. No student will be permitted to repeat a required graduate course more than once.

3. Fifteen semester hours of approved courses in extension may apply toward the completion of degree requirements, if no work is transferred from another institution. A maximum of 12 hours of approved extension courses may be used for certification.

4. The maximum number of hours which may be used from extension courses and transfer credit combined is 15.

5. Students are limited to earning 9 hours in any one field in extension.

6. Students must submit an application to take the final Master's degree examination within the first week of the summer term or two weeks of the semester in which they intend to take it. All applications should be submitted to the student's records adviser.

**NOTE:** All persons working toward administrative certificates in Education or who wish to add additional administrative certification shall be required to pass a screening examination.

**NOTE:** A candidate who fails the final Master's degree examination may, upon written consent of his advisory committee, be given a second examination not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the unanimous consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

## GRADUATE PROFESSIONAL EDUCATION CURRICULA

Graduate Professional Education Curricula are offered in three major areas within the Division:

### I. *Administration*

Elementary School Principals  
Secondary School Principals  
Superintendents

### II. *Curriculum and Instruction*

Elementary-School Classroom Teachers  
Industrial Arts Teachers  
Secondary-School Classroom Teachers  
Supervisors of Instruction  
Teacher Librarians

### III. *Health Education*

The administrative certificates issued by the State Department of Education for superintendents, principals (elementary and secondary) and supervisors are called Professional Administrative Certificates.

#### Curriculum for School Superintendents

##### Degree: Certificate of Advanced Study

##### Required Courses\*

Ed. Psych. 311, 320 .....	6
Ed. Found. 320 .....	3
C & I 301, 304 .....	6
Ed. Adm. 300 .....	3
Ed. Adm. 340 .....	3
Ed. Adm. 341 .....	2
Ed. Adm. 342 .....	3
Ed. Adm. 320 .....	2
Ed. Adm. 331 .....	3
Ed. Psych. 440 or 450 .....	3
Ed. Adm. 491 .....	3-6

##### Other Certification Requirements

- Applicant must hold a permanent Professional Certificate for teaching.
- Applicant must have completed 8 years of experience in the public schools which shall include at least 3 years as a classroom teacher and 3 years as a school superintendent or assistant superintendent.
- Applicant must secure a physician's statement of satisfactory health.
- Applicant must complete requirements for a Certificate of Advanced Study.



## Curriculum for Secondary School Principals

### Degree: Master of Arts

I. Required Courses	Program	A <sup>1</sup>	B <sup>1</sup>	C <sup>1</sup>	D <sup>1</sup>
Ed. Psych. 311, 320		6	6	6	6
Ed. Found. 320		3	3	3	3
C & I 304		3	3	3	3
Ed. Adm. 300		3	3	3	3
Ed. Adm. 331		0*	0*	3*	0*
Ed. Psych. 440 or 450		0*	0*	3	3
Ed. Adm. 311		3	3	3	3
Ed. Adm. 391		0	3	0	0
Ed. Adm. 497		6	0	0	0
C & G 303		3	3	0	3
II. Internship					
Ed. Adm. 353		3	3	0	3
Ed. Adm. 354, 355		0	0	0	4
III. Academic Courses Approved by Adviser		0	3	12	5
Total		30	30	36	36

### Other Certification Requirements

- Applicant must hold Professional Certificate for grades 7-12.
- Applicant must have had 3 years of successful teaching experience in grades 7-12 and 3 years as a secondary principal or assistant principal.
- Applicant must hold a Master's degree from an accredited institution.
- \*d. Ed. Adm. 331 and Ed. Psych. 440 or 450.

## Curriculum for Elementary School Principals

### Degree: Master of Arts

I. Required Courses	Program	A <sup>1</sup>	B <sup>1</sup>	C <sup>1</sup>	D <sup>1</sup>
Ed. Psych. 311, 320		6	6	6	6
Ed. Found. 320		3	3	3	3
C & I 301		3	3	3	3
Ed. Adm. 300		3	3	3	3
Ed. Adm. 331		3	3	3	3
Ed. Psych. 440 or 450		3	3	3	3
Ed. Adm. 310		3	3	3	3
Ed. Adm. 391		0	3	0	0
Ed. Adm. 497		6	0	0	0
II. Internship					
Ed. Adm. 350, 351, 352		0	0	0	0
III. Academic Courses Approved by Adviser		0	0	12	6
Total		30	30	36	36

A<sup>1</sup>—Thesis Program

B<sup>1</sup>—Problem Program

C<sup>1</sup>—36 Semester Hour Program

D<sup>1</sup>—Internship Program—Required for certification in West Virginia

\*The courses indicated are those which are necessary to meet certification regulations, some of these will already have been completed as part of another graduate program and will not have to be repeated. Additional information is to be found in the section dealing with the Certificate of Advanced Study.

### Other Certification Requirements

- a. Applicant must hold a permanent Professional Certificate for teaching in a self-contained classroom.
- b. Applicant must have had 3 years experience as a classroom teacher in grades 1-9 and 3 years as an elementary or junior high school principal or assistant principal.

### Curriculum for General Supervisors of Instruction

#### Degree: Master of Arts

I. Required Courses	Program	A <sup>1</sup>	B <sup>1</sup>	C <sup>1</sup>	D <sup>1</sup>
Ed. Psych. 311, 320		6	6	6	6
C & I 350 or 354		0	0	3	0
C & I 330 and Rdng. 324, 330 or 325		0	0	3	0
Ed. Found. 320		0	0	6	0
C & I 301		3	3	3	°
Ed. Adm. 300		3	3	3	3
Ed. Adm. 331		3	3	3	3
Ed. Psych. 440 or 450		3	3	3	3
Ed. Adm. 391		3	3	3	3
Ed. Adm. 497		0	3	0	0
C&G 303		3	3	3	°
II. Internship					
Ed. Adm. 356, 357, 358 and 359		0 <sup>°°</sup>	0 <sup>°°</sup>	0 <sup>°°</sup>	0 <sup>°°</sup>
III. Additional Courses Approved by Adviser		0 <sup>°</sup>	3 <sup>°</sup>	0 <sup>°</sup>	0 <sup>°</sup>
Total		30	30	36	36

A<sup>1</sup>—Thesis Program

B<sup>1</sup>—Problem Program

C<sup>1</sup>—36 Semester Hour Program

D<sup>1</sup>—Internship Program—Required for certification in West Virginia

### Other Certification Requirements

- a. Applicant must hold a permanent Professional Certificate.
- b. Applicant must complete 5 years of successful experience which shall include 3 years as a classroom teacher and 2 years as a general supervisor of instruction.
- c. Applicant must complete a Master's degree relevant to school instruction.
- °d. Ed. Found. 320, C & G 302 and 6 semester hours of appropriate courses in teaching areas.
- °°e. Ed. Adm. 356, 357, 358, and 359 constitute the internship in supervision and are offered in cooperation with the county in which the applicant is employed.

### Curriculum for Special Supervisors of Instruction

#### Degree: Master of Arts

I. Required Courses	Program	A <sup>1</sup>	B <sup>1</sup>	C <sup>1</sup>	D <sup>1</sup>
Ed. Psych. 311, 320		6	6	6	6
Ed. Found. 320		3	3	3	°
C & I 301 or 304		3	3	3	3
Ed. Adm. 300		3	3	3	3
Ed. Adm. 331		3	3	3	3
Ed. Found. 440 or 450		3	3	3	°
Ed. Adm. 391		0	3	0	0

Ed. Adm. 497	6	0	0	0
C&G 303	3	0	3	•
II. Internship				
Ed. Adm. 356, 357, 358, and 359	••	••	••	8••
III. Academic Courses Approved by Adviser	0°	6°	12	12
Total	30	33	36	36

#### Other Certification Requirements

- Applicant must hold a permanent Professional Certificate endorsed for teaching each specialization or for each school area for which an endorsement is sought.
- Applicant must complete 3 years of successful classroom teaching and 2 years of successful supervisory service in the area for which an endorsement is sought.
- Applicant must complete a Master's degree relevant to the supervision of instruction.
- Ed. Found. 320, Ed. Psych. 440 or 450, C&G 303 and 12 semesters hours of appropriate courses in the field of specialization.
- Ed. Adm. 356, 357, 358 and 359 constitute the Internship in supervision and are offered in cooperation with the county in which the applicant is employed.

A<sup>1</sup>—Thesis Program

B<sup>1</sup>—Problem Program

C<sup>1</sup>—36 Semester Hour Program

D<sup>1</sup>—Internship Program—Required for certification in West Virginia

#### Curriculum for Secondary School Classroom Teachers†°

##### Degree: Master of Arts

I. Graduate Courses in Education				12-18 Hr.
Required Courses				6 Hr.
	Program <sup>1</sup>	A	B	C
C & I 304		3	3	3
Ed. Found. 320 or C & G 303		3	3	3
Ed. Psych. 330		3	3	0
Ed. Psych. 320		3	3	0
C & I 391		0	3	0
C & I 497		6	0	0
Total		18	15	6
II. Approved Electives°				6 Hr. (Min.)
III. Graduate Courses in one of the candidate's certified fields••				12-18 Hr.
IV. Graduate Courses in another of the candidate's teaching fields•••				6 Hr. (Min.)

°Students who wish to pursue a program in home economics education must enroll in the Division of Family Resources.

••Candidates with library science as a major teaching field must follow the curriculum for Teacher-Librarians.

•••This provision does not apply to candidate pursuing Programs A or B.



### Alternate Program for II, III, IV

I. Graduate Courses in one of the candidate's certified teaching fields .....	18-24 Hr.
II. Free electives .....	0- 6 Hr.
Total for Master's Degree .....	30-36 Hr.

### Curriculum for Industrial Arts Teachers\*

#### Degree: Master of Arts

I. Required Courses	Program <sup>1</sup>	A	B	C
Ed. Psych. 330 .....	3	3	0	
Ed. Psych. 320 .....	3	3	3	
I.A. 400 .....	3	3	3	
I.A. 401 .....	3	3	3	
I.A. 402 .....	3	3	3	
C & I 391 .....	0	3	0	
I.A. 497 .....	6	0	0	
I.A. 405 .....	3	3	3	
Total .....	24	21	15	
II. Approved Electives .....	6	9	21	
(Students electing Option C should maintain a close balance in total hours between professional education and industrial arts courses.)				
Total for Master's Degree .....	30	30	36	

\*Students who wish to pursue a program in industrial arts education must enroll in this program.

A<sup>1</sup>—Thesis Program

B<sup>1</sup>—Problem Program

C<sup>1</sup>—36 Semester Hour Program

†NOTE: In some programs listed on pp. 220-221 a combination of undergraduate courses and courses listed in graduate program is necessary to meet certification requirements.

### Curriculum for Elementary School Classroom Teachers\*

#### Degree: Master of Arts

I. Required Courses	Program <sup>1</sup>	A	B	C	D	E
Ed. Psych. 330 .....	3	3	3	3	3	3
Ed. Psych. 320 .....	3	3	0	3	3	3
C & I 350 .....	3	3	3	0	3	3
C & I 340 .....	3	3	3	0	3	3
C & I 330 .....	3	3	3	3	3	3
Rdng. 300 .....	3	3	3	3	3	3
Ed. Found. 320 .....	3	3	3	3	3	3
C & I 301 .....	3	3	3	0	0	0
C & I 391 .....	0	3	0	3	0	0
C & I 497 .....	6	0	0	0	0	0
Total .....	30	27	21	18	18	
II. Approved Electives .....	0	3	0-15**	0	0	
III. Specialization .....	0	0	0-15	12	18	
Total for Master's Degree .....	30	30	36	30	36	

Curriculum for Teacher-Librarians\*

Degree: Master of Arts in Education

I. Graduate Courses in Education	12 Hr.
A. Required Courses in Education	6 Hr.
Ed. Psych. 320	
C & I 391	
B. Approved Electives	6 Hr. (Min.)

Curriculum and Instruction

C & I

205. **The Junior High School.** I, II. 2 hr. PR: Consent. Developing philosophy, program, and practices of the junior high school.
210. **Early Childhood Education.** SII. 3 hr. PR: CDFR 141, 142, C & I 100. An examination of the role that early childhood education plays in the development of the child. Attention is given to the scope, content, and nature of programs for young children as well as developing the knowledge, skills, and attitudes necessary for working in such programs. Students will be given opportunities to observe and participate in early childhood programs and to engage in research at this level.
211. **Early Childhood Education.** SII. 3 hr. PR: CDFR 141, 142, C & I 210. Continuation of C & I 210.
267. **The Music Education Program.** S. 3 hr. PR: Consent. Organization and administration of the complete Music Education program for grades 1-12.
280. **Special Problems and Workshops.** I, II, S. 2-4 hr. PR: 14 hr. in Education. To take care of credits for special workshops and short intensive unit courses on methods, supervision, and other special topics. Maximum of 8 semester hours may be applied toward the Master's Degree, of which no more than 6 semester hours will be in Extension.
287. **Student Teaching Clinical Experience in Elementary or Secondary Education.** I, II, S. 2-4 hr. PR: Consent. Advanced course in student teaching, stressing clinical procedures in classroom learning problems.
288. **Clinical Practices in Public-School Speech and Hearing Therapy.** I, II, S. 2-8 hr. PR: Consent. Includes experience in Grades 1 to 12. This course meets the requirements of SPA 282 and 283.
301. **The Elementary-School Curriculum.** I, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. An analysis of curriculum designs in elementary education with emphasis on methods and techniques of development.
304. **The Secondary-School Curriculum.** I, II, S. 3 hr. PR: High-school teaching experience, or consent. Emphasizes socio-economic and cultural influences on the curriculum; principles of curriculum development; curriculum building in the various teaching fields; techniques of experimentation and evaluation; and practice in curriculum building with special emphasis on unit construction.

\*A—Thesis required

B—Research problem required

C—36 semester hour program for classroom teacher

D—Concentration in Elem. Sch. Mathematics—Math. 231, 232, C & I 333, 395, or 438 (3 hr.)

E—Concentration in Early Childhood Ed.—C & I 210, 211, CDFR 248 or 241, 244 or 242, Speech 375, C & I 395 (3 hr.)

\*See dagger NOTE on page 220.

\*\*At least 9 hr must be in courses not offered by Education or Clinical Studies

307. **Curriculum Principles and Patterns in General Education. II.** 2 hr. PR: 6 hr. of undergraduate education. Major emphasis on principles, philosophy, and concepts of general education in secondary schools; means and ends in general education: core, subject matter, integrated studies, broad fields, activity.
309. **Problems in Elementary and Secondary-School Curriculum. I, II.** 2 hr. PR: 8 hr. of graduate education, including C & I 304. Critical study of selected problems in curriculum with special emphasis on research.
330. **Mathematics in the Elementary School. II, S.** 3 hr. PR: 20 hr. of undergraduate credit in elementary education or consent. Materials and methods of instruction for modern mathematics programs.
333. **Corrective Techniques in Mathematics Education. I, S.** 3 hr. PR: C & I 330. Materials and methods used in diagnosis and remediation of learning difficulties in mathematics.
340. **Science in the Elementary School. I, S.** 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. An analysis of methods, curriculum patterns, and trends in elementary school science. Attention is given to the understanding and development of scientific attitudes appropriate at the elementary school level.
350. **Social Studies in the Elementary School. I, II, S.** 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. Comprehensive consideration of objectives, content, methods, including unit procedures; materials including objects, models, exhibits, and museum items as well as textbooks, collateral reading, maps, and graphs; and means of evaluating social growth and development.
354. **Social Studies in Secondary Schools. I, S.** 3 hr. PR: Consent. Nature and function of social studies in the secondary school; utilization of community, state, national, and world resources in teaching; selection of content for teaching purposes; curriculum construction with emphasis on resource and teaching units.
357. **Principles of Economic Education. S.** 3 hr. A workshop for principals, teachers, and supervisors with emphasis on the economic structure of our society and methods of integrating economics into the school program. Sponsored jointly by the College of Human Resources and Education and the College of Commerce.
363. **Teaching Young and Adult Farmer Classes. I, S.** 2 hr. PR: Ed. Psych. 106. Participation in conducting young and adult farmer classes and school-community food preservation centers; organization, course of study, and methods of teaching and supervision, and young farmers' association.
364. **Organizing and Directing Supervised Farming Programs. II, S.** 2 hr. PR: Consent. Planning programs of supervised farming, supervising and evaluating such programs for all-day students, young farmers, and adult farmers.
380. **Special Topics. I, II, S.** 1-6 hr. PR: Consent.
383. **Seminar. I, II, S.** 1-6 hr. PR: Consent.
391. **Problem in Education. I, II, S.** 3 hr. Research for Master's degree in Education, option B.
395. **Practicum. I, II, S.** 1-12 hr. per sem. or term—aggregating not more than 12 hr. PR: 9 graduate hr. in Education. Enrollment with permission of adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences on problems and projects in Education.
438. **Survey of Major Issues in Mathematics Education. II, S.** 3 hr. PR: C & I 330. Individual and group research on selected topics in mathematics education.



460. Planning Programs and Courses for Vocational Agriculture Department. I, S 2 hr. PR: C & I 188. Gathering data, studying the farming problems of all-day students, young farmers, and adult farmers, and planning the total program for the department.
491. Project in Education. I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Education.
497. Research. I, II, S. 1-15 hr.

## Education Administration

### Ed. Adm.

300. Public School Organization and Administration. I, S. 3 hr. PR: 20 hr. of education courses. Provide basic concepts through which administrators, supervisors, and teachers gain understanding of basic problems related to the operation of schools and school systems.
310. The Elementary-School Principal. S. 3 hr. PR: 6 graduate hr. of elementary education, or consent. A study of the function of administration in the modern elementary school, emphasizing the role of the principal in the improvement of instruction, the development of curriculum, and the organization of personnel services.
311. The Secondary-School Principal. S. 3 hr. PR: Ed. Adm. 300 and high school teaching experience, or consent. Open only to graduate students in Education, late in candidacy. A study of the function of administration in the modern secondary school, emphasizing the role of the principal in the improvement of instruction, the development of curriculum, and the organization of personnel services.
320. Staff-Personnel Administration. S. 2 hr. PR or conc.: Ed. Adm. 300 consent. Selection, induction, direction, evaluation, improvement, and promotion of members of the administrative, supervisory, instructional, research, clerical, and maintenance staffs.
321. Pupil-Personnel Administration. I, II, S. 2 hr. PR or conc.: Pupil accounting, guidance, extracurricular activities, and control. Open only to senior students and graduates.
330. Principles of Educational Leadership. I, II, S. 2-8 hr. PR: Consent. An integrated study of the problems of school leaders in the areas of administration, supervision, and instruction.
331. Principles of Supervision. I, II, S. 3 hr. PR: Consent. Basic, general principles of elementary school, junior high school, and senior high school supervision.
340. Public-School Finance. II, S. 3 hr. PR or conc.: Ed. Adm. 300 and consent. Sources of school support; taxation; efficient management of school money, improved budget practices and adequate apportionment plans. To be taken late in student's candidacy.
341. School Buildings and Equipment. I, S. 2 hr. PR or conc.: Ed. Adm. 300 and consent. Philosophy, planning, and management of the school plant as an appropriate educational environment.
342. Public Education and the Law. I, S. 3 hr. Legal permissives and limitations involved in setting policy for, organization of, and administration of public schools.
343. School Surveys. I, II, S. 2 hr. PR or conc.: Ed. Adm. 300 and consent. Development of the educational survey as an instrument for improving educational procedures.
350. Current Practices in Elementary Education. I, II, S. 2 hr. PR: Consent. Critical analysis of modern techniques and practices in the elementary school.

351. **Administration in Elementary Schools.** I, II. 2 hr. PR: Consent. Practice in leadership pertaining to elementary school organization and administration according to the needs of the school and/or school system.
352. **Elementary-School Supervision.** I, II, S. 2 hr. PR: 6 graduate hr. of elementary education, or consent. Observing and practicing major activities of the supervisor in work with pupils and teachers. To be taken late in student's candidacy.
353. **Demonstration and Practice in the Supervision of Secondary-School Instruction.** I, II, S. 3 hr. PR: Consent. Observation and practice of approved methods and techniques in classroom supervision of instruction. To be taken late in student's candidacy.
354. **Practice Administration in the Secondary School.** I, II, S. 2 hr. PR: Consent. Internship study of school organization and administration.
355. **Problems in the Secondary School.** I, II. 2 hr. PR: Consent. Culminating internship course for principals. Required research project designed to improve instruction and/or administration of the school.
356. **Individual Supervision.** 2 hr. PR: Consent.
357. **Group Supervision.** 2 hr. PR: Consent.
358. **Supervision of Special Subjects.** 2 hr. PR: Consent.
359. **Supervision of General Programs.** 2 hr. PR: Consent.
385. **Practicum.** I, II, S. 1-12 hr. PR: Consent.
391. **Problem in Education.** I, II, S. 3 hr. Research for Master's degree in Education, option B.
470. **Inter-Disciplinary Approaches for School Administrators.** I, II. 6 hr. PR: Consent. A study of the academic disciplines pertinent to school administration.
480. **Seminar.** I, II, S. 1-6 hr. PR: Consent.
485. **Special Topics.** I, II, S. 1-6 hr. PR: Consent.
491. **Project in Education.** I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Education.
497. **Research.** I, II, S. 1-15 hr.

#### **Education Foundations**

##### **Ed. Found.**

300. **Sociology of Education.** I, II. 3 hr. An examination of education as a social institution; cultural and class influences on education; social roles and career patterns in the school system; the school and problems of the community.
320. **Philosophy of Education.** I, II, S. 3 hr. A study of educational aims, values, and criteria of education in a democracy. Stresses different systems of educational philosophies, the nature of thinking applied to methods and subject matter.
340. **Historical and Sociological Foundations of American Education.** I, II, S. 3 hr. A study of the development of American education. Emphasis placed upon movements and leaders.
380. **Special Problems and Workshops.** I, II, S. 1-6 hr. PR: Consent.
383. **Seminar.** I, II, S. 1-6 hr. PR: Consent.
385. **Practicum.** I, II, S. 1-12 hr. PR: Consent.
390. **Special Topics.** I, II, S. 1-6 hr. PR: Consent.
497. **Research.** I, II, S. 1-15 hr.

## Educational Psychology

### Ed. Psych.

231. **Sampling Methods. I.** 3 hr. PR: An introductory course in statistics. Methods of sampling from finite and infinite populations, choice of sampling unit, sample survey design, estimation of confidence limits and optimum sample size, and single- and multi-stage sampling procedures. (Equiv. to Stat. 231).
260. **Audio-Visual Resources for Instruction. I, II, S.** 3 hr. A survey of many types of materials available for teaching. Multi-sensory techniques, sources of materials, and practical classroom utilization are considered. Laboratory period per week is arranged.
311. **Statistical Methods 1. I, II, S.** 3 hr. PR: Math. 3. Basic concepts of statistical models, distributions, probability, random variables, tests of hypotheses, confidence, intervals, regressions, correlation, transformation, F and  $\chi^2$  distributions, analysis of variance of one- and two-way classification models, multiple range tests, missing plots, and sample size. (Equiv. to Psych. 311 and Stat. 311).
312. **Statistical Methods 2. I, II, S.** 3 hr. PR: Stat. 311. Extension of basic concepts of statistical models, design of experiments, multi-way classification models, factorials, split plot design, simple covariance, orthogonal comparisons, multiple linear and nonlinear regression and correlation analysis, chi-square, and non-parametric statistics. (Equiv. to Stat. 312).
320. **Introduction to Research. I, II, S.** 3 hr. PR: Ed. Psych. 211. Introduction to methods and techniques of research in education. Major emphasis on design, analysis, interpretations, and reporting of research.
321. **Design of Experiments. I.** 3 hr. PR: Ed. Psych. 312 or equiv. Extension of basic concepts of statistics to the more complicated models and use of samples, design and analysis of experiments over time and space, fractional replications, incomplete block design, cross-over designs, lattice designs, and least squares analysis for designs with unequal subclass numbers. (Equiv. to Stat. 321).
330. **Advanced Educational Measurement. I, II.** 3 hr. Background for educational measurement, the nature of evaluation, measuring and predicting pupil progress. Basic statistics including measures of central tendency, percentiles, variability, and simple correlation.
333. **Nonparametric Statistics. II.** 3 hr. PR: An introductory course in statistics. Single sample tests; for related samples, two independent samples, K related samples, K independent samples, and measures of correlation. (Equiv. to Stat. 333).
341. **Multivariate Method 1. I.** 3 hr. PR: Stat. 311. Introduction to elementary matrix operations, partial and multiple linear and non-linear correlation and regression analyses, and introduction to discriminant analysis. (Equiv. to Stat. 341).
342. **Multivariate Methods 2. II.** 3 hr. PR: Stat. 341 or equiv. This course includes a discussion of the multivariate normal distribution, tests of hypotheses about the sample mean vectors and variance-covariance matrices from a multivariate normal distribution, and analysis of variance of multiple responses in basic statistical designs. (Equiv. to Stat. 342).
343. **Statistical Analysis in Education. I, II, S.** 3 hr. PR: Ed. Psych. 330 or consent. Review measures of central tendency, percentiles, and correlation. Emphasis placed on correlation, regression, testing hypothesis, non-parametric tests, and other measures in analysis and inference.
360. **Production of Instructional Materials. I, S.** 3 hr. PR: Consent. Techniques planning and developing instructional materials for use in teaching are demon-



strated. Individual projects of planning and producing materials are carried out by the student.

- 361. **Communications and Educational Media. I.** 3 hr. PR: Consent. The psychological implications of communications media in learning and teaching. Attention to educational television, programmed instruction, cross-media, techniques and experimental and developmental programs.
- 362. **Administration and Management of Media Systems. II.** 3 hr. Media techniques with emphasis on selection and utilization of materials, media centers, in-service programs, budgetary planning, and curricular implementation.
- 385. **Practicum. I, II, S.** 1-12 hr. PR: Consent.
- 391. **Problem in Educational Psychology. I, II, S.** 3 hr. PR: Consent.
- 420. **Advanced Educational Research. I, II, S.** 3 hr. PR: Stat. 311 and consent. Identification of research problems in education, consideration of alternative designs and methods of investigations, and development of a research proposal at the advanced graduate level.
- 440. **Human Development and Behavior. I, II, S.** 3 hr. A survey of the psychological theories of human development. Contemporary theories are analyzed and compared with emphasis on their implication for classroom behavior and the educational process.
- 446. **Factor Analysis. II.** 3 hr. PR: Stat. 341. Alternative methods for factor extraction, communalities, rotation in orthogonal and oblique space, and estimation of factor scores (Equiv. to Stat. 446).
- 450. **Psychological Foundations of Learning. I, II, S.** 3 hr. A study of the psychological and philosophical foundations of major learning theories and their implications for instructional procedures.
- 451. **Principles of Instruction. I, II, S.** 3 hr. PR: Consent. Emphasizes the basic principles of teaching-learning process implied in major learning theories; study of factors in learning, variables in the instructional program, and principles of instructional design.
- 480. **Seminar. I, II, S.** 1-6 hr. PR: Consent.
- 481. **Special Topics. I, II, S.** 1-6 hr. PR: Consent.
- 497. **Research. I, II, S.** 1-15 hr.

## **Health Education**

### **Health Educ.**

- 301. **Advanced School Health. I, S.** 3 hr. PR: Health Educ. 101, 20 hr. of Education, graduate standing and consent. An analysis of problems in school health services, healthful school living, the nature of health education, and the scope of health instruction which confronts teachers and administrators.
- 305. **Philosophy of Health Education. I, S.** 3 hr. PR: Health Educ. 2, and 101, graduate standing and consent. Analysis of the scientific bases, purposes, procedures, and content, with implications for school and public health education.
- 306. **Community Health. II, S.** 3 hr. PR: Health Educ. 2, and 305 or equiv. Health problems requiring community action, basic public health activities, community organization for health protection, voluntary health agencies, school health programs and the role of state and federal agencies in the community health program.
- 376. **Evaluation of Health Information. I, S.** 3 hr. PR: Health Educ. 2, and 301, or 20 hr. of Education and consent. Study of published material to determine basic scientific accuracy and value.
- 494. **Seminar. I, II, S.** 1-6 hr. PR: Health Educ. 305. An overview and critical analysis of the literature and research in health education.

497. Research. I, II, S. 1-15 hr.
498. Practicum. I, II, S. 1-12 hr. PR: Health Educ. 494. Program planning, curriculum development and job functions in health education.

### Medical Technology

See Medical Center section, page 255.

### Industrial Arts

#### I.A.

280. Special Problems and Workshops. I, II, S. 1-6 hr. PR: 14 hr. in Education. To take care of credits for special workshops and short intensive unit courses on methods, supervision, and other special topics. Maximum of 8 sem. hr. may be applied toward the Master's Degree, of which no more than 6 sem. hr. shall be in extension.
300. Advanced Woodworking, Construction, and Finishing. II, S. 3 hr. PR: I.A. 102, 103, or equiv. Selection of advanced projects, analysis of construction, planning, and finishing, application of machine tools.
301. Design in Industrial Education. I, S. 3 hr. PR: Consent. Industrial education design; architectural drawing and model building. Emphasis on application of design components at the secondary school level.
302. Art Metal and Jewelry. I, S. 3 hr. PR: I.A. 104 or equiv. Creative design and construction of art metal and jewelry involving the utilization of sheet, bar, and wire stock. Development of units suitable for the secondary school level is stressed.
303. Upholstery and Finishing. I, S. 3 hr. PR: I.A. 102, 103, or equiv. and consent. Design and construction of upholstery units, reupholstery, finishing and re-finishing. Construction of teaching units in these areas.
304. Advanced Ceramics. II. 3 hr. PR: I.A. 121 or consent. Design in ceramics, construction of projects involving mold work, potter's wheel, and hand form methods. Experimentation with glazes including glaze composition. Development of suitable teaching aids involving ceramics.
305. Advanced Industrial Arts Crafts. II, S. 3 hr. PR: I.A. 121. Experiments with crafts media in depth in the areas of plastics and leather. Development of suitable teaching units involving crafts materials.
306. Advanced Industrial Arts Graphics. II, S. 3 hr. PR: I.A. 180 or equiv. Concentration in depth in one or more of the graphic arts media. Emphasis on offset methods of reproduction.
307. Advanced Electricity. II, S. 2 hr. PR: I.A. 131 or equiv. A study of the technical phases of electricity with emphasis on planning shop courses, shop equipment and layout, and development in industrial aids.
308. Sheet Metal Pattern Development. II, S. 3 hr. Layout problems involving parallel, radial, and triangulation methods. Construction of instructional units utilizing these principles.
309. Industrial Arts Therapy. I, II, S. 8 hr. Individualized instruction in the teaching techniques of industrial arts and therapeutic practices in rehabilitation of the handicapped.
383. Seminar. I, II, S. 1-6 hr. PR: Consent.
385. Practicum. I, II, S. 1-12 hr. PR: 8 graduate hr. in Education. Enrollment with permission of adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences on problems and projects in Education.

390. **Special Topics. I, II, S. 1-6 hr. PR: Consent.**
400. **History of Industrial Education. I, S. 2 hr.** Development of hand work instruction in Europe and the United States. Particular emphasis is placed on modern practices in industrial education and its leaders, their viewpoints, and contributions.
401. **School Shop Planning. I, S. 3 hr.** Selection, purchases, arrangements, installation and use of equipment for all instructional levels and types of school laboratories. Construction of 3-D scale models of typical industrial education laboratory facilities.
402. **School Shop Safety Programs. II, S. 2 hr.** Emphasis on safety measures appropriate to schools and industry, teacher liability. Students prepare a written report on an approved topic.
403. **Special Reports in Teaching General Shop. S. 3 hr. PR: I.A. 107 or equiv.** Problems peculiar to teaching industrial arts in the general shop.
404. **School Shop Safety Programs. II, S. 3 hr.** Consideration of factors involved in school shop accidents; safety measures appropriate to schools and industry.
405. **Curriculum Construction in Industrial Arts. S. 3 hr. PR: Consent.** Techniques used in building curriculum designs in industrial arts.
406. **Advanced Methods in Teaching Industrial Education. II, S. 3 hr. PR: I.A. 194 or consent.** Trends in industrial education reflecting modern teaching methods; classroom representation of industrial methods; effective use of the newer instructional media.
490. **Projects in Industrial Arts. I, II, S. 1-6 hr. PR: Consent.**
491. **Problems in Industrial Arts. I, II, S. 1-6 hr. PR: Consent.**
497. **Research. I, II, S. 1-15 hr.**

## **DIVISION OF FAMILY RESOURCES**

The Division of Family Resources offers work leading to the degree of Master of Science.

All candidates for the graduate degree must conform to the general regulations of the Graduate School and the rules of the Division of Family Resources.

After applying to the Graduate School, applications will be reviewed by the Graduate Admissions Committee of the Division. At that time, an applicant will be notified by the Chairman of the Graduate Admissions Committee of the Division that he is accepted as a Master of Science degree candidate, or is accepted as a "special" student (reapplication is required at a later date), or is not accepted for graduate study in the Division. A student must have a 2.5 overall undergraduate average and must maintain a 3.0 grade-point average in course work taken within the Division in order to be awarded the master's degree from the Division of Family Resources. Additional detailed information may be obtained by writing the Director of the Division.

The graduate program of the Division is designed to offer qualified students opportunity to work in a variety of different specializations as well as the opportunity to take graduate level course work in supporting disciplines.

The specializations generally will coincide with the subject matter areas offered in the Division. However, the specific course work requirements for the



degree of Master of Science will in all cases rest with the graduate guidance committee of the student, and be approved by the Director of the Division.

To enter the graduate program of the Division, an applicant must have a bachelor's degree from an accredited institution and sufficient background in the area of specialization to qualify for admission to graduate courses in that area.

As of January 1, 1967, *no* student will receive graduate credit for course work taken prior to or concurrent with the semester in which his graduate application is received by the Division. In very exceptional cases, and not to include any circumstances surrounding lateness of application, course work taken prior to application to the Graduate School may be approved with the written consent of the entire graduate guidance committee of the student. Attached to such an application for approval of prior course work will be a statement by the student explaining the circumstances of the situation. Such application will be submitted first to the Chairman of the Graduate Admissions Committee of the Division for approval before being sent for approval to the student's guidance committee.

A student will select either (A) the thesis or (B) the course work program:

(A). The student pursuing the thesis program will take a minimum of 30 semester hours of course work, including 6 semester hours of credit for the thesis. Before the student in the thesis program has enrolled in more than 15 hours of course work, his graduate guidance committee will approve in writing his total graduate program. The graduate guidance committee of each student will be considered by the student and the major professor in selecting a thesis topic and in completing the thesis requirement. The approval of the thesis following an oral examination by the graduate guidance committee of the student will be required before the degree is granted. The graduate guidance committee of each student shall consist of at least three members of the Graduate Faculty of the University, at least two of whom must be members of the Graduate Faculty of the Division of Family Resources.

(B). The student completing the course work option will take a minimum of 36 semester hours of credit, approved by his graduate guidance committee, and, near the end of his graduate study, be required to take a written comprehensive examination. This examination shall be prepared, evaluated and approved by at least two members of the Graduate Faculty of the University before the degree is granted.

Approval in writing must be secured in advance from the student's graduate guidance committee to elect graduate course offered at other institutions or by University Extension.

#### Home Economics Education

##### H.E. Ed.

311. Home Economics Curriculum. II. 3 hr. PR: Experience in teaching home economics or consent. Theory and research in curriculum applied to home economics. Emphasis on change within existing programs and development of new programs. Offered alternate even years.

312. **Supervision in Home Economics.** 3 hr. PR: Teaching experience and consent. Designed for home economics teachers preparing to serve as supervising teachers in off-campus training centers. Function of supervision and organization of supervised teaching program. Techniques for helping students in training for teaching home economics.
313. **Evaluation in Home Economics. I.** 3 hr. PR: 30 hr. of Home Economics, 7 hr. of Education or consent. Experience in devising, selecting, and using a variety of techniques for evaluating progress toward cognitive, affective, and psychomotor objectives in home economics. Offered alternate odd years.
314. **Adult Education in Home Economics. I.** 3 hr. PR: 30 hr. of Home Economics and 7 hr. of Education or consent. A study of adult education as that part of the local home economics program which contributes to meeting needs of people for continuing education throughout the various life stages. Attention given to organization of classes and to selection of content, methods, and materials. Offered alternate even years.

### **Textiles and Clothing**

#### **TC**

224. **Advanced Clothing Construction. I.** 3 hr. PR: TC 123 or consent. Offers opportunity for creative expression and for understanding of pattern design through handling of fabrics on dress form. Costumes are designed, draped and constructed.
227. **Advanced Textiles. I.** 3 hr. PR: TC 27. Comparative characteristics of all textile fibers are presented. Physical and chemical properties are explained with reference to fiber morphology and/or manufacturing processes. Textile fiber products legislation is reviewed.

### **Housing and Design**

#### **HD**

233. **Interior Design II. II.** 3 hr. PR: HD 33, 133 or consent. Technical and design information necessary to comprehend and function within the contemporary home furnishings market.

### **Child Development; Family Relations**

#### **CDFR**

244. **Family and Individual in the Community. I.** 3 hr. PR: One course in the family, or sociology, or consent. Social psychological analysis of the individual in the family and in other social systems. Involves the study of role relationships, community processes and attitudes and values as they affect the behavior of the individual.
245. **Family Development. I, II.** 3 hr. PR: CDFR 144 or consent. A course designed to increase knowledge and understanding of comparative family patterns through the use of cross-cultural and historical materials. Intensive study of family development in contemporary United States with special attention to social class differences and the use of the life cycle and developmental task concepts as analytic tools.
246. **Adolescent Development. I, II.** 3 hr. An investigation of the adolescent in contemporary American culture, including normative physical, social, and personality development; and relationships within various typical social settings (e.g., family, school, community, peer group).
341. **Cognitive Development of the Child. I.** 3 hr. PR: CDFR 141 and 142 or consent. A normative survey of logical thought development from infancy to adolescence. Emphasis is directed toward the growth of quantity-numerical,

spatial-geometric, and logical operations concepts and their relationship to basic sensory-perceptual functioning during the 2-year to 12-year-old interval.

- 345. **Socio-Emotional Development of the Child.** II. 3 hr. A study and examination of contemporary theory and research into various facets of the socialization process and the development of attitudes in the child.
- 347. **Comparative Study of the Family.** II. 3 hr. PR: CDFR 144 or consent. The comparative method as a framework for family analysis. The family as both an independent and dependent variable in social change in relation to other social systems. Modal and unique patterns of structure and functioning. Alternative methods for achieving similar cultural objectives. Converging patterns in the contemporary world setting.
- 348. **Theories of Child Development.** II. 3 hr. PR: CDFR 141, 142 or consent. An examination of the major theoretical conceptions of child development. The work of Werner, Piaget, Lewin, Freud, and the American learning theorists will be covered.

#### **Foods; Institution Administration**

##### **FIA**

- 255. **Experimental Foods.** II. 3 hr. PR: FIA 55, Chem. 131, or consent. (1 hr. lec., two 2-hr. labs.) The study and experimentation with factors involved in food processing under various conditions. Offered alternate odd years.
- 258. **Laboratory Practice in Institution Management.** I, II. 3 hr. PR: FIA 158 and consent. Experience under supervision in planning, preparing and serving food in an institution. Selection of place and type of experience to be determined by needs of students.

#### **Home Management; Family Economics**

##### **HMFE**

- 261. **Consumer Economics.** II. 3 hr. PR: Econ. 51, HMFE 161, or consent. Course designed to help students understand the role of consumer in our economy. Involves the study of research methods and techniques being used to identify, understand, and solve consumer problems.

#### **Nutrition**

##### **NTR**

- 271. **Human Nutrition.** I. 3 hr. PR: NTR 71, biochemistry, physiology. The role of food nutrients in the physiological and biochemical processes of the body; nutritional needs of healthy individuals under ordinary conditions and in periods of physiologic stress. Offered alternate even years.
- 273. **Family and Community Nutrition.** II. 3 hr. PR: Consent. Special emphasis is given to nutritional status of the individual and family in the community. Students study nutritional problems and work toward their solutions through fieldwork.
- 274. **Diet Therapy.** II. 3 hr. PR: NTR 271, Zool. 271. Adaptations of normal diet for diseases whose prevention or treatment is largely influenced by diet. Offered in alternate odd years.

#### **Family Resources—Seminars**

- 282. **Seminar in Clothing or Textiles.** I, II, S. 1-4 hr. per sem., max., 9 hr. Critical examination of significant contemporary issues in the area of clothing or textiles.



283. **Seminar in Housing or Design.** I, II, S. 1-4 hr. per sem.; max., 9 hr. Critical examination of significant contemporary issues in the area of housing or design.
284. **Seminar in Child Development or Family Relations.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of child development.
285. **Seminar in Foods and/or Institution Administration.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of foods and/or institution administration.
286. **Seminar in Home Management or Family Economics.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of home management or family economics.
287. **Seminar in Nutrition.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of nutrition.
381. **Seminar in Home Economics Education.** I, II, S. 1-4 hr.; max. 9 hr. PR: Senior standing and consent. A review and discussion of home economics education at secondary, college, and adult levels. Emphasis on current research and trends in selected areas. Offered alternate odd years.
384. **Seminar in Child Development or Family Relations.** I, II, S. 1-4 hr. per sem.; max., 9 hr. An examination of research procedures used in the study of family relationships and a critical examination of current research in this area.
387. **Graduate Seminar in Nutrition.** I, II, S. 1-4 hr. per sem.; max., 9 hr. Review and discussion of recent progress in foods and/or nutrition research.

#### **Family Resources—Research**

390. **Research Methods in Family Resources.** I, II, S. 3 hr. PR: Introductory statistics or consent. A review of research methodology, experimental design, and statistical analysis as relevant to problems in home economics, child development, and family relations. Required for all master's thesis candidates in the Division of Family Resources.
391. **Assigned Topics.** I, II, S. 1-6 hr. per sem.; max. 9 hr.
497. **Research.** I, II, S. 1-15 hr.

## **DIVISION OF SOCIAL WORK**

The graduate program in social work education leads to the degree of Master of Social Work, accredited by the Council on Social Work Education. It spans two academic years and one summer session.

In social work, social science knowledge is utilized to understand the behavior of individuals, groups, and communities. This knowledge is employed by the social worker to develop a system of practice that will enable people and their institutions to achieve desirable social functioning.

Learning occurs in the classroom and through direct experience in working with people to alleviate personal problems and to improve adverse conditions in communities. The student spends two full semesters in social work settings which have been carefully selected to provide learning experiences (field instruction).

The Appalachian region, of which West Virginia is a part, offers unique opportunities to study and work with a changing social environment. Parts of the territory are redeveloping from worked-out farms and mines to new industrial areas, bringing about out-migration and in-migration of population with

problems of personal adjustment and the re-establishment of social organizations. This natural laboratory of human experience is utilized during the semesters on campus and those in field instruction in agencies and programs in or near West Virginia.

## Curriculum

The five major instructional components are human behavior and the social environment, practice, social welfare policy and services, field instruction, and research.

The social worker is concerned with human behavior as it is manifested in the individual, in groups, and in communities. In order to understand these kinds of social phenomena, concepts from anthropology, sociology, psychology and psychiatry have been selected for study. They are applied to an interpretation of conformity and deviance, including behavior, such as over-compliance, neuroses, delinquency, mental illness, anomie, and alienation. Behavior is interpreted as the product of interaction between the individual and the social organizations and cultural norms to which he is exposed. Those concepts are selected from the social sciences which enhance this interpretation.

The Division of Social Work offers a program which emphasizes a comprehensive approach to social work practice. The student is helped to become a "specialized generalist" capable of understanding and actively engaging in a wide array of professional behaviors relevant to the range of social work responsibilities.

Throughout his first year in graduate studies, the student is taught a comprehensive approach to social work practice, providing him with the foundation principles, techniques, and values to practice social work with social systems of various sizes—from individuals to communities—as particular tasks require.

In his second year the student has an opportunity to develop specialized expertise to complement his generalist capacities by electing a concentration in either social work practice affecting individuals, families, and groups, or social work practice affecting organizations, institutions, and communities.

Emphasis throughout the social welfare policy and services courses is placed upon values, conflict of interest, professionalism, methodology, history, ideology, economics, and socio-legal-political change as they relate to policy formation, and the tasks, resources and roles of the social work professional. The courses deal with an analysis of the creation, institutionalization and planning of social welfare policy and service in a democracy. Extensive consideration is given to selected social problems, such as poverty, health, family planning, crime, housing, urban decay, the redistribution of political and economic power, the socio-economic problems of Appalachia, and planning the future, as they affect and are affected by policy formulation.

The objective of the research sequence is to prepare the graduate social work student as a consumer of research information having a bearing on solving problems the social worker confronts. Also, the student is prepared to participate in research as an investigator familiar with some of the technical and practical aspects of research design and activity. The student is also prepared to identify research problems and formulate research questions in social work.

Field instruction is an integral part of the graduate social work program. It is the component through which the student is enabled to incorporate into his professional behavior the content learned in all areas of the curriculum.

In both the first and second year, students are assigned to field instruction placements for a period of one semester. These field teaching and learning experiences are provided by field instructors who may be employed by the Division of Social Work or who may be members of an agency staff. All field instructors work closely with faculty consultants in providing an opportunity for practice and learning in accordance with the division's educational goals and objectives.

The learning experiences provided are designed to assist the student in acquiring an integrated practice and in developing the discipline and self-awareness essential to the professional social worker.

Primary consideration in making field instruction assignments is in the selection of field settings and placements which can fulfill the educational goals and objectives of the division and which can meet the particular educational needs of the student. In the selection of assignments, consideration is given to the student's area of interest, family situation, and stipend requirement.

### Field Instruction Agencies—1969-70 Academic Year

Agency	Field Instructor
Appalachian Center The University Extension Services (Monongalia County), W. Va.	David Williams Assistant Professor
Appalachian Mental Health Center Elkins, W. Va.	C. J. Meade Field Instructor
Appalachian Regional Hospital Beckley, W. Va.	Mel Henry Field Instructor
Centerville Clinic Centerville, Pa.	Walter Golembiewski Field Instructor
Children and Family Service Wheeling, W. Va.	Palmer Ulman Field Instructor
Fairmont Clinic Fairmont, W. Va.	Anita Harbert Field Instructor
Family Counseling—Travelers Aid of the Kanawha Valley Charleston, W. Va.	Virginia B. Myers Instructor
Family Service Association of Morgantown, W. Va.	Patricia Keith Instructor
Harrison County Guidance Center Clarksburg	Jim Chapman Field Instructor
Health and Welfare Association of Allegheny County Pittsburgh, Pa.	Jerry Radtke Field Instructor
Information and Volunteer Services of Allegheny County Pittsburgh, Pa.	Aaron Sacks Catherine Hamilton Field Instructors
Robert F. Kennedy Youth Center Morgantown, W. Va.	C. Courtney Elliott Assistant Professor



NASW—Charleston  
Charleston, W. Va.

NASW—Morgantown  
Morgantown, W. Va.

Shack Settlement House  
Pursglove, W. Va.

Social Work Unit of  
Department of Psychiatry  
University Hospital  
West Virginia University

South Hills Y.M.C.A.  
Pittsburgh, Pa.

Southern West Virginia  
Regional Health Council  
Bluefield, W. Va.

Valley Counseling Center  
Morgantown, W. Va.

VA Hospital  
Clarksburg, W. Va.

VA Hospital  
Chillicothe, Ohio

VA Hospital  
Huntington, W. Va.

VA Hospital  
Leech Farms  
Pittsburgh, Pa.

Youth Development Center  
Loysville, Pa.

Roger Switzer  
Field Instructor

Helen Ellison  
Assistant Professor

David Williams  
Assistant Professor

Ralph Rogers  
Carolyn Bridgens  
Patricia Porterfield  
Instructors

Jerry West  
Field Instructor

James Baker  
Field Instructor

Wayne McDevitt  
Field Instructor

Carl Benedum  
Field Instructor

Arlen D. Miller  
Nicholas J. Kempf  
Field Instructors

Robert Ewing  
Field Instructor

Alma Burgess  
Field Instructor

Joseph Anderson  
Field Instructor

### **Kanawha Valley Graduate Center**

Students may earn some credit toward the Master of Social Work degree at the Kanawha Valley Graduate Center. For details write to: Chairman, K.V.G.C. Program, Division of Social Work, West Virginia University, Morgantown, West Virginia 26506.

## **Admissions**

### **Requirements**

Students are admitted for graduate study in the Division of Social Work who meet all of the following requirements:

1. Graduation with a bachelor's degree from any *accredited* college or university.
2. Proof of academic achievement. Graduate school regulations require an undergraduate grade-point average of at least 2.5 for approval of candidates as *regular* graduate students. An undergraduate grade-point average of 2.0 is required of all candidates for approval as *probationary* graduate students.
3. Evidence of potential to practice social work, such as commitment to human service, and concern about and ability to work effectively with people.

### **Admission With Advanced Standing**

Students may be admitted to the second-year program after the satisfactory completion of one year of comparable social work education, if they meet the requirements for admission to the graduate program.

### **Part-Time Program**

Applicants may elect to extend their graduate program up to a maximum of four years by specifically requesting part-time status in their application for admission. To be accepted the student must meet the usual University and Division of Social Work entry requirements, have a definite objective of completing the master's program within a four-year period, and present an acceptable plan for completing requirements.

### **Financial Aids**

The Division of Social Work has a limited number of scholarships, traineeships, and educational stipends which are available for full-time graduate social work students who meet the qualifications.

Federal traineeships from the National Institute of Mental Health, Children's Bureau, and the Rehabilitation Services Administration, cover tuition, living expenses, and dependency allowances. Veterans Administration traineeships provide stipends for students who have field placements in Veterans Administration institutions. Board of Regents scholarships entitle students to remission of all fees except activity and field instruction fees.

Application for and information on financial aid from these sources should be made to the Chairman of Admissions at the time of application for admission to the Division of Social Work. Information concerning other public and private financial aids may be obtained from the Chairman of Admissions.

### **Recommended Application Date**

Applicants are urged to complete their applications before March 1 in order to guarantee their consideration for admission and for school administered financial aids. First-year students are admitted only in the fall of each academic year. Students admitted to the program with second-year status enter in the summer session.

A Graduate School catalog may be obtained by writing directly to Dean, Graduate School, Oglebay Hall, West Virginia University, Morgantown, West Virginia 26506.

### **Requirements for the Degree of Master of Social Work**

The degree of Master of Social Work is conferred by the University upon those students who satisfactorily complete the requirements as established by the Graduate School. These requirements are:

1. Completion of graduate courses approved by the Division of Social Work totaling not fewer than 61 semester hours.
2. Satisfactory completion of all components of the graduate program.
3. A cumulative average of 2.7 overall for the total graduate program.

## Required Graduate Social Work Program, 1970-1972

### First Year, 1970-71

Fall Semester	Credit
S.W. 321—Human Behavior and the Social Environment I	4
S.W. 331—Social Welfare Policy and Services I	4
S.W. 340—Introduction to Social Work Practice	5
S.W. 497—Research (Principles and Theory)	3
	<hr/> 15

### Spring Semester

S.W. 381—Field Instruction	5-14
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### Second Year, 1971-72

#### Summer Session

S.W. 322—Human Behavior and the Social Environment II	2
S.W. 332—Social Welfare Policy and Services II	2
S.W. 341—Practice Affecting Individuals, Families, and Small Groups	2
S.W. 351—Practice Affecting Organizations, Institutions and Communities	2
S.W. 497—Research (Methods and Design)	3
	<hr/> 11

#### Fall Semester

S.W. 481—Advanced Field Instruction	5-14
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#### Spring Semester

The following are the recommended courses for the spring semester. Within the recommended courses, all students are allowed to take one elective. One practice course (either S.W. 441 or S.W. 451) is required and the research course is required. Students, with approval of their advisers, may choose to take other electives instead of S.W. 421, 431, or 460. If a student decides to take electives, he can take them within or outside of the division. It is conceivable that he could also take both S.W. 441 and S.W. 451 under such a plan, if he so desired.

S.W. 421—Human Behavior and the Social Environment III	2
S.W. 431—Social Welfare Policy and Services III	2
S.W. 441—Advanced Practice Affecting Individuals, Families and Small Groups	3
or	
S.W. 451—Advanced Practice Affecting Organizations, Institutions and Communities	3
S.W. 460—Social Work Management	3
S.W. 380—Special Topics (Elective)	2- 3
or	
S.W. 480—Seminar (Elective)	2- 3
S.W. 497—Research (Research project or advanced course)	2
	<hr/> 14-15

#### Courses of Instruction

**General prerequisites.** A concentration of courses in the social sciences is highly desirable for entrance into social work education because this knowledge is reviewed and applied to the practice of social work. Students lacking this background are expected to compensate for it by independent study.

With the exception of S.W. 200, 210, and 220, enrollment in graduate social work courses is designed for students admitted to the graduate program. Courses on



the 200 level are open to advanced undergraduate and graduate students in other programs. They do not provide credit toward the M.S.W.

Some graduate students in other programs, after consultation with their advisers and subsequent approval by the Division of Social Work, may want to work out minors in Social Work and take certain graduate social work courses.

## **Social Work**

### **S.W.**

200. **Introduction to Social Welfare.** 3 hr. A general introduction to social welfare in the United States: history, philosophy, programs, and problems. Social welfare as a social institution is examined. The emphasis is on what the citizen needs to know about welfare problems and solutions.
210. **The Field of Social Work.** 3 hr. PR: S.W. 200. A critical analysis of theory and practice in major areas of welfare, including public assistance, the care of dependent children, mental health, and services for the aged.
220. **The Profession of Social Work.** 3 hr. PR: S.W. 200 and 210. Open to seniors and on consent of instructor. A supervised field experience program involving a weekly placement in a local community agency.
321. **Human Behavior and the Social Environment I.** 4 hr. Human behavior is interpreted as the product of interaction between the individual and the social organizations and cultural norms to which he is exposed. The effects upon the individual and his family of deprivation caused by poverty and social exclusion are studied. Selected theories of personality are related to the types of behavior that develop under different environmental conditions. The mental patient, his identification, control, treatment, and experiences within his family and community provide additional evidence of the effect of environmental factors upon behavior.
322. **Human Behavior and the Social Environment II.** 2 hr. In this course the objective is to increase understanding of social organizations and small groups as they develop, change, and affect behavior of those affiliated with them.
331. **Social Welfare Policy and Services I.** 3 hr. A critical analysis of the historical rise of social welfare policy in the western world plus the rise of the social work profession. An introductory understanding of the dynamics of policy formulation and social planning with particular reference to income maintenance.
332. **Social Welfare Policy and Services II.** 2 hr. A critical appraisal of the policies underlying the delivery of social services in various settings and fields of practice, both public and voluntary, with emphasis upon the need for new policy for new services.
340. **Introduction to Social Work Practice.** 5 hr. Introduction to basic concepts, principles, values and skills intrinsic to all social work practice with an emphasis on the range of social tasks and the nature and purposes of social work intervention.
341. **Practice Affecting Individuals, Families, and Small Groups.** 2 hr. Social Work Practice "A". This course builds on S.W. 340 by elaborating and differentiating specific processes which have the primary goal of aiding in restoring, maintaining, or enhancing the social functioning of individuals, families, and small groups through various social systems.
351. **Practice Affecting Organizations, Institutions, and Communities.** 2 hr. Social Work Practice "B". This course builds on Course 340 by elaborating and differentiating specific strategies and tactics in social work practice with the primary goal of effecting social change in organizations, institutions, and communities through the various social systems.

380. **Special Topics.** 1-6 hr. Examinations of selected issues in social work and social welfare. In the past topics have included issues in public welfare policy, social work practice implications related to the contemporary racial crisis, social welfare in developing countries, citizen participation in social planning and change, use of groups in staff development, etc.
381. **Field Instruction I.** 5-14 hr. Field instruction and practice in selected settings under general direction of the faculty.
421. **Human Behavior and the Social Environment III.** 2 hr. An intensification of the understanding of behavior of individuals and of societies by the student is achieved through an intensive review of theoretical material that has been covered in courses S.W. 321 and S.W. 322. The knowledge is applied to experiences the student has had in his field work as well as to types of deviant behavior. Effort is made to achieve an integration with knowledge from other courses in order to appreciate the interrelationship of behavior of individuals, societal groups, and communities. Capable student may select projects which will help them extend their knowledge and its application upon which they work independently.
431. **Social Welfare Policy and Services III.** 2 hr. Emphasis is placed upon the student's ability and skill in formulating policy procedure, social planning and social action, in relation to certain major social problems and issues as a change agent. Social problems are developed from the perspective of the students' interests and concerns.
441. **Advanced Practice Affecting Individuals, Families, and Small Groups.** 3 hr. A seminar in advanced practice to enhance expertise in that area of practice begun in S.W. 341. This course will integrate field experience as well as content of S.W. 351.
451. **Advanced Practice Affecting Organizations, Institutions, and Communities.** 3 hr. A seminar in advanced practice drawing on courses S.W. 340 and S.W. 351 and field experience to enhance expertise in a concentration in social work with the primary goal of effecting change in organizations, institutions, and communities through the various social systems.
460. **Social Work Management.** 3 hr. An intensive examination of the concepts, principles and skills of administration, consultation, supervision, and teaching in social work practice.
480. **Seminar.** 1-6 hr. Intensive study in the student's area of special interest. In the past topics have included those listed under S.W. 380 as well as study of indigenous groups, human sexuality and social work, issues and trends in social work, etc.
481. **Advanced Field Instruction II.** 5-14 hr.
497. **Research.** 1-15 hr.

#### Courses for Employed Workers

The Division of Social Work offers a series of 300-level courses which are designed to meet the needs of men and women employed in health, education, and welfare agencies. Such courses are given both on campus and in extension.

300. **Public Welfare.** 3 hr. An introduction to the history, philosophy and structure of public welfare, including public assistance and programs for the aged, survivors and disability insurance; historical development, administrative structures, perspectives.
305. **Child Welfare.** 3 hr. The physical, social and psychological needs of children; services provided by public and private agencies to parents and to children who need protection, assistance, foster care, adoption, or services in their own homes; historical background.

307. **Introduction to Social Casework I.** 3 hr. The psychology of client and case-worker and the general character of casework help. Lecture, discussion, and analysis of selected case materials.
308. **Introduction to Social Casework II.** 3 hr. PR: S.W. 307 or equiv. Further study in the general character of casework help. Case analyses, lectures, and class discussion of casework method.
310. **Introduction to Growth and Behavior I.** 3 hr. Study of man as a psychological, biological entity. Structure and dynamics of personality development. Models of personality.
311. **Introduction to Growth and Behavior II.** 3 hr. PR: S.W. 310 or equiv. Further study of the dynamics of personality growth and behavior. Special consideration of deviant development and behavior.

## **Industrial Relations**

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A graduate program leading to a Master of Science Degree in the field of industrial relations is offered through the cooperation of the College of Commerce, the Department of Psychology, the Department of Sociology, and the Institute for Labor Studies.

Applicants for admission must have a baccalaureate degree from an accredited university or college with a minimum of 21 hours of undergraduate work in the social sciences, including at least 3 hours in statistics and 3 hours in labor economics. The social sciences are interpreted to include economics, history, political science, psychology, sociology, and general social science. In addition to the course requirements, applicants must have a 2.5 (based on 4.0) grade-point average in undergraduate work. Students who do not have the necessary undergraduate courses may be admitted as special students, but undergraduate deficiencies must be removed in the first semester of residence without graduate credit. All applicants should plan to take the Graduate Record Examination immediately. Any admission to the program will be considered tentative until Graduate Record Examination Scores are received.

To receive the master of science degree the candidate must complete 30 hours of graduate work which will include the following required courses. An average of 3.0 must be maintained in courses taken prior to thesis.

- Economics 262—Collective Bargaining or  
Economics 261—Trade Unionism. 3 hr.
- Psychology 201—Personnel Psychology. 3 hr.
- Sociology 233—Industrial Sociology. 3 hr.
- Statistics 311—3 hr.
- Industrial Relations 430—Seminar in Industrial Relations. 3 hr.
- Industrial Relations 440—Thesis. 6 hr.

The remaining hours will be chosen from the following courses after consultation with the adviser. While the listed courses are preferred, considerable latitude may be given the student by his adviser to choose other courses which are particularly appropriate to his background and interest. Approval must be obtained in advance.



<b>Industrial Engineering</b>	<b>Hr.</b>	<b>Economics</b>	<b>Hr.</b>
220—Theo. Ind. Eng'g. & Org.	3	211—Micro. Econ. Anal.	3
222—Job Eval. & Wage Incent.	2	212—Macro. Econ. Anal.	3
		263—Economics of Wages	3
<b>Psychology</b>		360—Adv. Labor Econ.	3
304—Leadership and Human Rel.	3	364—Seminar, Labor Econ.	3
307—Prac. Indust. Interview	3	390—Readings in Econ.	1-3
313—Directed Studies	1-3	<b>Law</b>	
		264—Labor Law	3
<b>Management</b>		<b>Sociology</b>	
216—Personnel Management	3	203—Collective Behavior	3
225—Business Policy	3	204—Complex Organizations	3
<b>Political Science</b>		<b>Rehabilitation Counseling</b>	
341—Adm. Org. and Man.	3	320—Vocational Development and	
440-441—Dir. Read. in Publ. Adm.	2-4	Occupational Choices	3

The student's thesis must be prepared in conformity with the general regulations of the Graduate School. The final draft must be approved by the thesis committee, composed of the thesis chairman and two other faculty members. At least two of these committee members must be members of the Executive Committee of the Graduate Program in Industrial Relations.

## Institute of Biological Sciences

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The Institute of Biological Sciences, comprising the departments associated with the life sciences, offers advanced study and research on a disciplinary and interdisciplinary basis in areas of experimental biology ranging from the molecular to the population level. The staff of the institute includes a faculty of more than eighty Ph.D.'s encompassing nine departments located on the Downtown, Evansdale, and Medical Center campuses. Work toward the Ph.D. degree may be pursued in the basic botanical and zoological sciences, the agricultural sciences, or the medical sciences. All programs leading to the Ph.D. degree also offer the M.S. degree. There are a few additional programs which offer only the M.S. degree.

No rigid statement about academic requirements for graduate studies in the biological sciences can be made. Each department sets its own requirements, details of which should be obtained from the appropriate departmental chairman who are listed below along with the research activities of their departments. In general, students with good academic records and majoring in chemistry, biology, or the agricultural sciences are desirable applicants. All students should be adequately prepared in mathematics, biology, and chemistry, especially the latter. Potential graduate students are urged to take, during their senior year as undergraduates, the Graduate Record Examination, both the aptitude and advanced tests. It is advisable to prepare for the foreign language requirements for the Ph.D. degree by taking undergraduate courses in two languages, preferably French and German.

A general application form may be obtained from The Director, Institute of Biological Sciences, Room 1098 Agricultural Sciences Building, West Virginia University, Morgantown, W. Va. 26506. Inquiries concerning individual programs, financial assistance, departmental requirements, and professional career opportunities should be sent to the appropriate departmental chairman as listed below.

## **Botanical and Zoological Sciences**

*Biology:* Dr. E. C. Keller, Jr., 200 Brooks Hall.

Research Areas—Molecular biology: methyl transferase function, control of betacarotene synthesis, mechanisms of steroid actions in phycomycetes, biochemistry of plant hormones. Cellular biology: nuclear function and plant morphogenesis, the physiology and biochemistry of avian and mammalian germ cell, synchronized cell division, cytology, endocrine systems in reproduction. Organismic biology: plant physiology, plant and animal morphology, vertebrate morphogenesis, animal behavior, systematic and taxonomic studies of animal life of the Appalachian region, chemotaxonomy. Population biology: ecological systems and environmental stress, especially air and water pollutants, ecology of algae, fisheries biology, productivity of streams and reservoirs, vertebrate ecology and speciation, plant speciation, ecological taxonomy.

## **Agricultural Sciences**

*Faculty of Agricultural Biochemistry:* Dr. George A. McLaren, 1046 Agricultural Sciences Building.

Research Areas: Enzymes, carbohydrates, lipids, proteins, nutritional biochemistry, plant biochemistry and biochemical genetics.

*Agronomy and Genetics:* Dr. Collins Veatch, 1090 Agricultural Sciences Building.

Crop Science: Field crop, forage and pasture production and management; crop rotation systems; cutting management, stand establishment and longevity of forages; weed control; low temperature hardiness, physiological effects of chemicals on crop plants and weeds. Genetics: Immunogenetics of protein polymorphism and their biochemical basis; biochemical genetics of enzyme polymorphism; physiological-biochemical basis of heterosis; molecular basis of development and differentiation; cytogenetic, cytotaxonomic and cytological studies in plants; freeze preservation of biological materials. Soil Science: Soil chemical properties and their interrelationships, characterization of soil phosphorus and organic nitrogen compounds; nutrient availability as related to soil structure, time and rate of potassium fertilization on crops; hydrology of watersheds on shale soils, factors relating to frost heaving, surface mine land reclamation; micronutrient availability; soil fertility; forest-soils relationships.

*Animal and Veterinary Sciences:* Dr. Marvin R. McClung, G-036 Agricultural Sciences Building.

Research Areas—Nutrition: Control of feed intake; nonprotein nitrogen metabolism; bacterial carbohydrate metabolism in ruminants. Physiology: Magnesium homeostasis; pituitary-ovarian relationships; dietary factors and thyroid

function; sperm metabolism; breeding seasons and reproductive efficiency. Veterinary Pathology: Avian infectious synovitis; pathogenesis of uterine infection. Genetics and Breeding: Genetic and environmental factors in production of meat, milk and eggs; genetic effects of irradiation; evaluation of breeding systems. Food Science: Effects of environmental, genetic, and age differences on quality of meat, milk, and eggs.

*Plant Pathology and Bacteriology:* Dr. H. L. Barnett, 401 Brooks Hall.

Research Areas—Agricultural Bacteriology: Microbiology of streams and ponds; microbial decomposition in sanitary landfills; physiology of fungi; effects of light on fungi; mycoparasitism. Plant Pathology: Physiology of host-parasite relationships; late blight of potato and tomato; disease of field and forage crops; biology and control of plant parasitic nematodes; oak wilt; decay of hardwoods and wood products.

## Medical Sciences

*Anatomy:* Dr. Donald L. Kimmel, 4053 Basic Sciences Building, Medical Center.

Research Areas—Gross Anatomy: Anatomical variations and anomalies, and electromyographic studies of specific muscle groups. Microscopic Anatomy: Studies of cells, tissues and organs, under normal and experimental conditions with histochemical, electron microscopic, autoradiographic, regenerative, and fluorescent techniques. Developmental Anatomy: Experimental and descriptive embryology, cellular differentiation, and dedifferentiation, organizers and the effects of different environments on development. Neuroanatomy: Experimental, comparative and embryological studies of specific nerve cell groups and nerve pathways in the spinal cord, brain stem, cerebellum and cerebrum.

*Biochemistry:* Dr. Reginald F. Krause, 3127 Basic Sciences Building, Medical Center.

Research Areas—Nutrition: Vitamin A and carotene metabolism. Enzymology: enzyme kinetics. Biological Transport: fatty acids and amino acids. Organic synthesis of biological compound: "sulfones." Immuno Chemistry: complement factors; antigen-antibody reactions. Genetics: biochemical defects in inherited diseases. Lipid Metabolism: arthrosclerotic disease and cardiac hypertrophy. DNA and RNA metabolism in cancer cells.

*Microbiology:* Dr. John M. Slack, 2078 Basic Sciences Building, Medical Center.

Research Areas—Immunology: Studies on the mechanisms of antigen-antibody reactions and the development of hypersensitivity. Virology: Characterization of respiratory viruses using tissue cultures and fluorescent antibody techniques. Parasitology: Host-parasite relationships between various protozoa and insects of animal hosts. Physiology: Nutrition and metabolism of a variety of pathogenic microorganisms. Genetics: Basic studies on the mechanisms of genetics including transformation of genetic information. Electron Microscopy: Cytological studies of the fine structures of microorganisms and the influence of environment on these structures.



Pharmacology: Dr. William W. Fleming, 3152 Basic Sciences Building, Medical Center.

Research Areas—Autonomic Pharmacology: autonomic regulation of the cardiovascular system and of smooth muscle; sensitivity to autonomic drugs; synthesis, release and metabolism of catecholamines; cholinesterase inhibitors. Chemotherapy: antimalarial agents, effects of chemotherapeutic agents on intestinal flora and fauna. Biochemical Pharmacology: drug metabolism; effects of drugs on lipid and nucleic acid metabolism. Endocrine Pharmacology: mechanism of action of steroids; metabolism of sex accessory tissues. Neuropharmacology: mechanism of action of anticonvulsants; neuromediators in the central nervous system. Toxicology: metabolism of toxic agents; tolerance to organophosphorus compounds.

Physiology and Biophysics: Dr. M. F. Wilson, 3055 Basic Sciences Building, Medical Center.

Research Area—Cellular, membrane transport and electrical properties of excitable tissue; integrative and behavioral functions of the nervous system; regulation and dynamics of the circulation, respiration, endocrine, and electrolyte balance systems; theoretical and experimental biophysics; and biomedical instrumentation.

## Interdepartmental Programs

Genetics and Developmental Biology Faculty: Dr. Randall W. Reyer, 4013 Basic Sciences Building, Medical Center.

Research Areas—Bacterial and viral genetics; cytogenetics; developmental genetics; differentiation; embryology; forest genetics; blood group genetics; human genetics and cytogenetics; mammalian genetics; molecular and biochemical genetics; morphogenesis; plant genetics; population genetics and statistics.

Plant Physiology Faculty: Dr. Morris Ingle, 2072 Agricultural Sciences Building.

Research Areas—Plant soil water relations; environmental physiology; micrometeorology; physiological effects of air and water pollution; tissue culture; cytokinins; auxins; morphogenesis; physiology and biochemistry of plant growth; physiology of cold hardness; post-harvest physiology; organic acid metabolism; polyphenol metabolism; physiology of chilling injury, role of boron and other micro-elements; herbicide physiology; fruit physiology.

Reproductive Physiology: Dr. E. K. Inskeep, G016 Agricultural Sciences Building.

Research Areas—Physiology of spermatozoa; fertility and viability of aged ova; regulation of the life span and function of the corpus luteum; effects of light and other environmental factors on reproduction; physiology of uterine contractions; dietary mineral levels and reproduction; endocrinology and metabolism; role of gonadotropic hormones in control of steroidogenesis; control of estrus and ovulation and use of artificial insemination in beef cattle, swine and sheep; and physiology of intrauterine contraceptive devices. The members of

the Faculty of Reproductive Physiology and their research facilities are located in various departments: Anatomy; Animal Science; Biology; Genetics; Internal Medicine; and Obstetrics and Gynecology.

Further information regarding these programs may be obtained from the Director, IBS, Room 1098 Agricultural Sciences Building, West Virginia University, Morgantown, W. Va. 26506.

## School of Journalism

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The School of Journalism offers work leading to the degree of Master of Science in Journalism. The purpose of the degree is to provide the student who already has a sound background in technical and professional journalism education an opportunity to broaden his communications horizons by gaining a critical insight into the theory and practice of the communications industries; the degree also is intended to introduce the student to research methods applicable to communications problems.

*Admission.* In order to be admitted to the Master of Science in Journalism program, the student must have a baccalaureate degree in journalism from an accredited institution or must have completed a core program in journalism or must demonstrate competency in a minimum number of areas prescribed by the School of Journalism. The prospective student also must have a 3.0 average in undergraduate Journalism courses.

*Requirements.* The student will be required to meet the following requirements for the degree:

1. Complete a minimum of 30 semester hours, including a thesis with a maximum of 6 hours credit.
2. At least 18 hours of work, including the thesis, must be taken in the School of Journalism.
3. A minor of 9-12 hours credit must be taken outside the School of Journalism.

*Examination.* On completion of course requirements, the candidate shall be required to pass an oral examination on his thesis and on his competence in his major and minor fields.

### Journalism

#### Journ.

203. **Media Management and Promotion.** I, II, S. 3 hr. PR: Journ. 113 and 115. Problems, functions, and responsibilities in communications media organization, operation, management, and promotion. Special emphasis on case study of media management and promotion in the Appalachian area.
204. **Advertising Markets and Media.** I, II, S. 3 hr. PR: Journ. 113. A study of advertising planning, buying, and scheduling by advertisers, media, and advertising agencies on national and local levels. Seminar discussions and assignments with special emphasis on problems related to Appalachian markets and media.

210. **Advertising Production.** II. 3 hr. PR: Journ. 110. Techniques and mechanics of producing print advertising. Study includes art, typography, printing processes, layout, and make-up. Student must acquire tools and supplies for lab work; cost: about \$10.00.
220. **Feature Writing and Marketing.** I, II. 2 hr. Open to all University students. A seminar-type course devoted to the writing, editing, and marketing of features; scientific and technical writing.
221. **Public Relations Interning.** II. 3 hr. Open only to junior, senior, and graduate public relations majors. Here the student learns through on-the-job training and from reports of those who have on-the-job experience. Course is structured along a public relations agency organization and operations.
227. **History of Journalism.** I, S. 3 hr. PR: Hist. 52 and 53 or consent. Open to all University students. A study of the impact of the American press on the nation; the development of today's communications media from the beginnings in seventeenth century England and in the American colonies; an examination of the great names in journalism from the standpoint of their contributions to today's journalism; freedom of the press and its current implications.
228. **Law of the News Media.** II. 3 hr. For seniors and graduate students. A study of the law as it affects the mass media. Considered are such areas as libel, public records, criminal pre-trial publicity, freedom of information, obscenity.
230. **Editorial and Interpretive Writing.** I, II. 3 hr. Open to all University students. The student will analyze and write editorials and commentaries. He will study typical editorial pages and the ethics governing editorial page content. He will also become familiar with libel, privacy, contempt, and other problems—operating and political—as they arise.
281. **Public Affairs Programing.** I. 3 hr. PR: Journ. 183 or consent. The basic principles of evaluating and documenting public issues into television and radio presentation form. Includes methods of program selection, research, writing, sources and type of content materials.
282. **Public Affairs Programing.** II. 3 hr. PR: Journ. 281. Continuation of Journ. 281. An in-depth laboratory course in actual preparation of materials for inclusion in public issues programs. Work includes filming and recording interviews, background materials, obtaining and selecting supporting sound, music, art.
286. **Radio and Television Advertising.** I. 3 hr. PR: Journ. 113 or Speech 184 and consent. Development of radio and television writing techniques. Media planning, buying, and market analysis. Federal regulations affecting advertising in broadcast media.
289. **Documentary Motion Picture Production.** II. 3 hr. PR: Journ. 189 and Journ. 281 or Speech 184 and Speech 280. An in-depth development of the techniques and resources utilized in the production of a complete documentary motion picture. Areas of study include films, processing, cinematography, editing, research, writing, music, narration. Laboratory-oriented. Lab fee. (Also listed as Speech 289).
302. **Seminar in Communications Theory.** II, S. 3 hr. A study of communications theories and problems of contemporary mass media.
312. **Seminar in Institutional Relations.** II. 3 hr. A study of the problems of public relations and public information officers of educational institutions of higher learning and public service organizations; thorough study of the publics which these officers attempt to reach.
315. **Seminar in Journalism Education.** I, S. 1-3 hr. Discussion of journalism education problems. Each student will do an individual research project planned to provide for his professional development as a teacher of journalism. Emphasis on secondary school problems.



339. **Seminar in Advanced Advertising Management Problems.** II. 3 hr. Recently developed ideas and techniques in advertising, advertising research, and media management.
343. **International Communications.** I. 3 hr. International news gathering and dissemination—including wire services, broadcast satellites, and political barriers—will be examined, particularly as these factors affect a free exchange of information within the world community. Efforts by the United Nations to encourage news exchange and to lower news barriers will be a major case examination.
344. **Seminar in the Foreign Press.** II. 3 hr. Studies in legal and communications problems of the international flow of news and opinion, international press codes; communications media of major countries.
380. **Thesis.** I, II, S. 2-6 hr.
401. **Research Methods and Literature.** I, S. 3 hr. A study of methods common to communications research; critical examination of communications literature, the mass media; problems of communicating with the various publics; general independent research projects by each student.
422. **Seminar.** I, II, S. 1-4 hr.
482. **Seminar in Public Affairs Broadcasting.** I, II, S. 6 hr. Investigation and discussion of current problems and practices in the field of broadcast journalism. The student and the instructor will choose a problem, or a phase of a problem, for analysis and research as the course progresses.
497. **Research.** I, II, S. 1-15 hr.

## Medical Center

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The Departments of Anatomy, Biochemistry, Microbiology, Pharmacology, and Physiology and Biophysics each offer programs of study leading to the Master of Science and the Doctor of Philosophy degrees. Admission is permitted only with approval of the department concerned. Students should contact the chairman of the major department and request permission to do graduate work well in advance of the time of registration.

### Requirements for Admission

1. The student's undergraduate scholastic standing shall be a quality equivalent to that required for admission to the School of Medicine or School of Dentistry.

2. A transcript of the student's grades should be available to the major department at least six weeks before the beginning of the semester in which the student desires to start his graduate work. In addition, two letters of recommendation from professors in major and minor fields are desirable.

3. The students may be asked to appear in person.

4. The candidate must meet the admission requirements of the department in which he pursues his major study. Qualifying entrance examinations and/or the Graduate Record Examination may be required.

5. After acceptance and before registration, the student and his adviser shall formulate a schedule for the entire year.

## **Standards for Graduate Study and Requirements For Master of Science Degree**

1. No credits are acceptable toward an advanced degree which are reported with a grade lower than "C." Certain departments require the student to maintain a "B" average or that two-thirds of the credits carry a grade of "B."
2. A minimum of 30 hours of related graduate courses shall be required. Twenty hours shall be in the major field which includes 6 hours credit for a thesis.
3. An examination in the major and related fields shall be given before the student can qualify for his final oral examination.
4. A thesis is required and shall represent original research by the candidate for the degree.

## **Requirements for Master of Science Degree for Students Enrolled in School of Medicine or Dentistry**

1. Medical or Dental students shall fulfill the above requirements for admission and scholarship.
2. Students enrolled in the Schools of Medicine or Dentistry who hold a Bachelor's degree from an approved institution and desire to do additional work for the Master's degree must also register in the Graduate School.
3. Medical and dental students may count preclinical courses in basic sciences toward the Master's degree as long as they complete not fewer than 24 semester hours of graduate courses that are not required for the degree of Doctor of Medicine or Doctor of Dental Surgery.
4. All courses offered to meet these requirements must be courses numbered between 200 and 497 that are approved by the Graduate School and listed in this bulletin.
5. A thesis is required.

## **Requirements for Doctor of Philosophy Degree**

1. The student must meet the standards of scholarship required for the Master's degree and complete or offer previous graduate credit of no less than 60 semester hours of related course work, exclusive of research or thesis. However, these 60 semester hours may include 6 hours of research or thesis credit earned for the Master's degree.
2. The residence requirements set by the Graduate School for the degree of Doctor of Philosophy must be met.
3. Students will be required to take a comprehensive preliminary or qualifying examination, qualify in a foreign language, and take a final examination as specified by the regulations of the Graduate School. Arrangements must be made with the major department which will determine the scope and nature (either oral or written or both) of these examinations. Also, the major department may request the Dean of the Graduate School to approve the substitution for French, German, or Russian of a more suitable foreign language.
4. Before admission to the final examination, the candidate must submit a thesis that presents the results of the candidate's individual investigation, demonstrates a mastery of research techniques, and represents a definite contribution to knowledge.

## **Requirements for Master of Science Degree for Students Who Are Doctors of Medicine or Dental Surgery**

1. Such students must meet the standards of scholarship required for the Master's degree and complete not less than 30 semester hours of course work, exclusive of research or thesis, beyond that required for the professional degree.
2. The requirements, cited for the Doctor of Philosophy Degree, concerning examinations and thesis must be met.

## **Medical Center Courses Open to Graduate Students**

### **Anatomy**

#### **Anat.**

301. **Gross Anatomy of the Trunk.** (With Medical student.) I. 5 hr. PR: Consent. A detailed study of the human body with a complete dissection.
302. **Gross Anatomy of Head and Neck.** II. 3 hr. PR: Consent.
304. **Gross Anatomy of the Extremities.** II. 2 hr. PR: Consent.
305. **Microanatomy and Organology.** (With Medical students.) I. 6 hr. PR: General biology or equiv. and consent. Structure and function of cells, tissues, and organs.
306. **Gross Anatomy.** (With Dental students.) I and II. 8 hr. PR: General zoology and consent. A study of the human body including dissection.
308. **Neuroanatomy.** (With Dental students.) II. 2 hr. PR: Consent. A gross and microscopic study of the central nervous system. (See also Conjoined Course 375).
309. **Microanatomy and Organology.** (With Dental students.) I. 6 hr. PR: General zoology and consent. Structure, function, and embryology of tissues and organs with emphasis on teeth and supporting structures.
401. **Advanced Gross Anatomy.** I, II. 2-6 hr. per sem. PR: Anat. 301, 302, 304, and consent. A morphological and functional analysis of selected regions. With dissection.
402. **Advanced Developmental Anatomy.** I, II. 2-3 hr. per sem. PR: Anat. 301, 302, 304, and consent. Detailed developmental anatomy of the fetal period and childhood. With dissections and analysis of variations and malformations.
403. **Seminar in Anatomy.** I, II. 1 hr. per sem. Course may be repeated. PR: Consent. Presentation and discussion of special topics of current or historical interest.
404. **Applied Anatomy.** I, II. 2-6 hr. per sem. PR: Consent. Detailed study of anatomy adapted to the needs of the advanced student.
405. **Experimental Embryology.** II. 3 hr. PR: Embryology and cellular physiology or biochemistry and consent. An analysis of development, differentiation and regeneration. Offered in alternate (odd numbered) years.
406. **Advanced Neuroanatomy.** I. 2-4 hr. per sem. PR: Conjoined Course 375 and consent. A detailed study of selected areas of the brain and spinal cord. Offered in alternate (even numbered) years.
407. **Advanced Study of the Autonomic Nervous System.** I. 2-4 hr. per sem. PR: Conjoined Course 375 and consent. Special topics on the peripheral autonomic nervous system and central areas of integration. Offered in alternate (odd numbered) years.



451. **Advanced Microanatomy and Organology.** II. 2 hr. PR: Microanat. 305 or 309 and consent. An extension of the major topics included in Microanat. 305 or 309 with special emphasis on recent contributions.
497. **Research.** I, II, S. 1-15 hr.

## Biochemistry

### Biochem.

231. **General Biochemistry.** II. 7 hr. PR: Inorganic Chem., Organic Chem., and consent.
  - A. Lectures and conferences
  - B. Laboratory, demonstration and conference for medical, dental and graduate students—3 hr.
337. **Biochemistry of the Amino Acid and Proteins.** I. 3 hr. PR: Biochem. 231 or equiv., consent. Offered in 1969-70 and every second year.
339. **Seminar in Biochemistry.** I, II, S. 1 hr. PR: Biochem. 231 or equiv., consent. Presentation and discussion of special topics.
399. **Special Topics.** I, II, S. 1-12 hr. PR: Consent.
405. **Lipid Biochemistry.** I. 3 hr. PR: Agr. Biochem. 291 or Med. Biochem. 231, and consent. A consideration of the chemical and physical properties of the various classes of lipids and their biochemical and physiological pathways within the cell and cellular particulates. Offered in even years.
423. **Biochemistry of the Immune Globulins and Related Proteins.** I. 2 hr. PR: Biochem. 231. A study of the biosynthesis, chemistry and biological properties of proteins important in immunology. Offered in 1970-71 and alternate years.
430. **Biochemical Preparations.** I, II, S. 2-5 hr. PR: Biochem. 231 or equiv., consent. Emphasis on biochemical methods.
432. **Enzyme Kinetics.** II. 3 hr. PR: Biochem. 139, 231, or equiv., consent. An introduction to the physical mechanisms of enzyme action.
497. **Research.** I, II, S. 1-15 hr.

## Microbiology

### Microbiol.

220. **Microbiology.** II. 4 hr. (For Pharmacy students.) PR or Conc: Biochemistry. A study of pathogenic microorganisms including immunology and antimicrobial agents.
223. **Microbiology.** II. 5 hr. (For Medical Technology students; Graduate students with consent.) PR or Conc: Organic Chemistry. Basic microbiology with emphasis on immunology, pathogenic microorganisms and clinical laboratory techniques.
224. **Parasitology.** II. 4 hr. (For Medical Technology students.) Study of animal parasites and vectors of disease.
301. **Microbiology.** I. 4-7 hr. (For Medical and Graduate students.) (4 hr. for Graduate Students taking only the lectures). PR: Organic Chemistry, Biochemistry. A detailed study of pathogenic microorganisms.
302. **Microbiology.** I. 5 hr. (For Dental students.) PR: Organic Chemistry. A detailed study of pathogenic microorganisms with emphasis on oral flora.
316. **Basic Microbiology.** I. 4 hr. (For Graduate students.) PR: Organic Chemistry; biology recommended; consent. A detailed review of the major groups of microorganisms including morphology and physiology.

317. **Special Problems in Microbiology.** I, II, S. 1-6 hr. per sem. with a total of 24 hr. available. PR: Microbiol. 316 or equiv. Graded as U or S.
318. **Diagnostic or Determinative Microbiology.** I, II, S. per sem. with a total of 24 hr. available. PR: Microbiol. 316 or equiv. Graded as U or S.
319. **Comparative Cytology.** II. 4 hr. PR: Microbiol. 320; consent as limited enrollment. Basic features in structure and function of animal, plant, and microbial cells and their organelles. Projects in electron microscopy. 1972.
320. **Electron Microscopy.** I. 2 hr. PR: Consent as limited enrollment. Introduction to preparation techniques and operation of the electron microscope. 1971.
321. **Bacterial Physiology.** I. 3-4 hr. (lect. 3 hr; with lab. 4 hr.) PR: Microbiol. 316 or equiv.; Organic Chemistry; Biochemistry or conc. Physiological studies on bacteria including nutrition, metabolic pathways, growth, and death.
322. **Microbial Genetics.** II. 4 hr. PR: Microbiol. 316 or equiv.; consent. This course describes microbial mutation and adaptation, bacterial gene transfer mechanisms, and cytoplasmic inheritance. 1972.
323. **Immunology.** II. 4 hr. PR: Microbiol. 316 or equiv. A thorough study of antigens, antibodies, and their reactions both *in vitro* and *in vivo* with emphasis on theoretical and experimental problems. 1972.
324. **Virology.** II. 4 hr. PR: Microbiol. 316 or equiv.; Biochemistry. A comprehensive study of the basic biology of human, animal, and bacterial viruses. 1971.
325. **Medical Mycology.** I. 4 hr. PR: Microbiol. 316 or equiv. A study of fungi pathogenic for man and animals. 1971.
326. **Seminar.** I, II, S. 1 hr. PR: Microbiol. 316 or equiv. Graded as U or S. This will include the history of Microbiology.
327. **Parasitology.** II. 4 hr. (For Graduate students.) Study of animal parasites and vectors of disease.
497. **Research.** I, II, S. 1-15 hr.

## Pathology

### Path.

328. **Pathology.** (For Dental students.) II. 4 hr. PR: Microscopic Anat. 209. A study of disease processes with emphasis on fundamentals.
350. **Pathology.** II. Hematology. 4 hr.
351. **General Pathology.** (For Medical students, Second Year.) Yr. 17 hr. PR: Consent. Includes gross and microscopic studies with demonstrations. (Note: Appropriate material in Clinical Pathology is integrated in Path. 351).
353. **Oral Pathology.** (For Dental students.) I. 3 hr. A study of the etiology of the diseases of the teeth and their investing structures.
355. **Advanced Oral Pathology.** I, II. 1-3 hr. PR: Consent. Advanced seminar and laboratory study of local and systemic disease processes affecting the oral structures.
356. **Advanced Pathology.** I, II. 3 hr. PR: Consent; Path. 328 or 351. Microscopic and gross specimens from selected autopsies.
497. **Research.** I, II. 1-15 hr.

## Pharmacology

### Pharmacol.

261. **Pharmacology.** (For Pharmacy students.) I. 5 hr. PR: Physiology. Lecture and laboratory course dealing with the principles, clinical applications, and laboratory methods in pharmacology.

360. **Pharmacology.** (For Dental students.) I. 4 hr. PR: Physiology. Lecture and laboratory work dealing with the pharmacologic actions and therapeutic uses of drugs.
361. **Pharmacology.** (For Medical students, Second Year.) II. 6 hr. PR: Physiology. Lecture-conference-laboratory course covering the general principles, pharmacodynamic actions, and therapeutic applications of clinically useful drugs.
363. **Toxicology.** II. 1 hr. PR: Consent. A study of the toxicological effects of official and non-official drugs and other harmful agents with special emphasis on symptomatology and treatment of the effects of economic poisons.
364. **Advanced Pharmacology.** I. 1-6 hr. PR: Pharmacol. 361 or equiv. Advanced lecture and laboratory study in specialized areas of pharmacology.
365. **Advanced Pharmacology.** II. 1-6 hr. PR: Pharmacol. 361 or equiv. Advanced lecture and laboratory study in specialized areas of pharmacology.
460. **Special Topics in Pharmacology.** I, II, S. 1-6 hr. per sem. Assigned study on an individual basis for advanced students.
461. **Seminar in Pharmacology.** I, II. 1 hr. per sem. PR: Pharmacol. 361 or graduate status in basic medical sciences.
462. **Literature Survey.** I, II. 1 hr. per sem. PR: Graduate status in pharmacology. A survey of the current literature pertinent to the field of pharmacology including journals of allied biological sciences.
463. **Preceptorship.** I, II. 1-2 hr. per sem. PR: Pharmacol. 361 and consent. A critical evaluation of the preparation and delivery of lectures in specified areas of pharmacology. For advanced graduate students.
497. **Research.** I, II, S. 1-15 hr.

## Physiology and Biophysics

### Physiol.

244. **Introduction to Biophysics.** (Advanced Undergraduate and Selected Graduate students.) S. 3 hr. PR: General Physics and Calculus or consent. Designed to provide introduction to: theory and application of instrumentation, bioelectricity, biophysics of special senses, radiation biology, and control systems.
248. **Experimental Design.** (Advanced Undergraduate and Selected Graduate students.) I, II, S. 3 hr. PR: Consent. Theory and practical experience in selection of problems, design of experiments, and processing of physiological data using small laboratory digital computers. 1 lect., 2 lab.
343. **Fundamentals of Physiology.** (Dental and Graduate students.) I. 5 hr. PR: College Physics, Algebra, and Chemistry. Analysis of basic facts and concepts relating to cellular processes, organ systems, and their control. Common lecture with Physiol. 345. 3 lect., 1 conf., 1 lab.
345. **Medical Physiology.** (Medical and Graduate students.) I. 6 hr. PR: College Physics, Algebra, and Chemistry. Analysis of basic facts and concepts relating to cellular processes, organ systems, and their control, with clinical correlations. 3 lect., 2 conf., 1 lab.
346. **Neurophysiology.** (Medical and Graduate students.) II. 3 hr. PR: College Algebra, Physics. Properties of excitable tissues (nerve and muscle), synaptic transmission, reflexes and central nervous system function, and behavior. 2 lect., 1 conf.
347. **Biophysical Analysis.** II. 4 hr. (Alternate Years). PR: Math. 17 (Calculus 111) and Physiol. 345 or consent. Introduction to "Systems Biophysics," the methods of analysis and their application in the quantitative study of biological phenomena. 3 lect., 1 conf.-seminar.



440. **Special Topics. I, II, S.** 1-4 hr. PR: Consent. Assigned study designed to develop research skills.
441. **Physiological Methods. II.** 4 hr. PR: Physics 113, 114 or equiv. Theory and application of technics essential to acquisition and processing of physiological data. 2 lect., 2 conf.-lab.
442. **Advanced Physiology. I.** 4 hr. PR: Math. 16 (Calculus 11) and Physiol. 345 and 346. Lecture-seminar in physiological and biophysical topics with emphasis on recent and quantitative developments. 2 lect., 2 conf.-seminar.
443. **Advanced Physiology. II.** 4 hr. PR: Math. 16 (Calculus 11) and Physiol. 345 and 346. Lecture-seminar in physiological and biophysical topics with emphasis on recent and quantitative developments. 2 lect., 2 conf.-seminar.
444. **Graduate Seminar. I, II.** 1 hr. PR: Graduate status and consent.
446. **Cellular Biophysics. I.** 4 hr. (Alternate Years). PR: Calculus 11 and Physical Chemistry. Thermodynamics of membrane transport, biophysics of excitable tissues (nerve, muscle, receptors) and non-excitable tissues (frog skin, secretory and red blood cells, etc.). 2 lect., 2 conf.-seminar.
447. **Systems Biophysics. II.** 4 hr. (Alternate Years). PR: Physiol. 347 or consent. A quantitative analysis of physiological regulatory systems. 2 lect., 2 conf.-seminar.
497. **Research. I, II, S.** 1-15 hr.

#### Conjoined Basic Sciences Courses

(In the curricula of the Basic Sciences in the Medical Center, certain courses are conducted on non-departmental or interdepartmental lines. These have been designed as conjoined courses.)

314. **Medical Human Growth and Developmnt.** (Medical and Graduate students.) II. 1 hr. PR: Consent. Basic considerations of embryology, organogenesis, teratology, and other factors influencing intrauterine growth and development and the adaptation of the fetus to extrauterine life.
321. **Medical Statistics.** (Medical and Graduate students.) I. 1 hr. PR: Consent. An introduction to the statistical analysis of biologic phenomenon as related to medicine.
370. **Medical Genetics.** (Medical and Graduate students.) II. 1 hr. PR: Consent. An introduction to the understanding of genetics and heritable disease in man.
375. **Neurobiology.** (Medical and Graduate students.) II. 6 hr. PR: Anatomy 301 and Physiology 345, or consent. A study of the anatomy and physiology of the nervous system correlated with clinical neurology.

## SCHOOL OF DENTISTRY

The School of Dentistry and its Department of Orthodontics offer a program of advanced study and clinical training leading to the Master of Science degree. The program requires a minimum of 24 months of full-time residency in the School of Dentistry, and is designed to qualify dentists for careers in orthodontic clinical practice, teaching, and research.

Inquiries concerning this program should be directed to the Department of Orthodontics or the office of the Dean of Dentistry. Applications will be processed in the School of Dentistry and applicants will be recommended to the Graduate School for admission.

## **Requirements for Admission to Orthodontic Program**

1. Graduation from an accredited dental school.
2. Evidence of scholastic and clinical achievement that would indicate the applicant's ability to progress in a program of this nature.
3. Each applicant must file with the department all information requested in the department application form.
4. The applicant must be approved by the chairman of the department and the Dean of the School of Dentistry.

## **Requirements for Master of Science Degree for Students Enrolled in Orthodontic Program of School of Dentistry**

1. General fulfillment of requirements of the Graduate School.
2. Twenty-four months of consecutive residency at the School of Dentistry.
3. Must pass an oral examination by a special committee selected by the adviser, the department chairman, and the Dean of the School of Dentistry.
4. An approved Master's thesis based on original research in an area related to orthodontics.
5. Candidates must complete a minimum of 56 credit hours. These include 35 hours of orthodontic courses, a minimum of 9 hours of selected basic science subjects, and a minimum of 6 hours of elective allied subjects and a thesis (6 hours).
6. Must have demonstrated satisfactory clinical competence in his field.
7. Must have maintained a grade level commensurate with graduate education.

### **Orthodontics**

316. **Biomechanics.** I, II, S. 2 hr. PR: Consent. A study of the design and function of the teeth and their surrounding structures, and the response of these tissues to orthodontic procedures.
317. **Orthodontic Technique.** I, II, S. 2 hr. PR: Consent. A laboratory course in the techniques related to the fabrication and manipulation of orthodontic appliances.
318. **Orthodontic Materials.** I, II, S. 1 hr. PR: Consent. A study of the physical properties of the materials used in orthodontic appliances.
319. **Orthodontic Diagnosis.** I, II, S. 1-3 hr. PR: Consent. A seminar type class on the technique of patient examination, acquiring diagnostic records, and analyzing and correlating this information to the treatment of clinical problems.
320. **Cephalometrics.** I, II, S. 1-3 hr. PR: Consent. The use of radiographic cephalometry in studying growth of the human face, analysis of dento-facial malformations, and evaluation of orthodontic treatment.
321. **Orthodontic Mechanics.** I, II, S. 1-4 hr. PR: Biomechanics 316 and Orthodontic Technique 317. A seminar and laboratory course on basic orthodontic mechanical properties.
322. **Advanced Orthodontic Mechanics.** I, II, S. 1 hr. PR: Orthodontic Mechanics 321. A continuation of Orthodontic Mechanics 321 involving more difficult type cases and introducing more sophisticated appliance therapy.
323. **Growth and Development.** I, II, S. 1-5 hr. PR: Consent. A seminar type course on the normal and abnormal growth of the human head and its application to the field of orthodontics.

- 325. **Orthodontic Seminar.** I, II, S. 1-8 hr. PR: Consent. Discussions involving all branches of dental science, but with special emphasis on the orthodontic interest. Assigned topics and articles in the literature are discussed.
- 326. **Orthodontic Clinic.** I, II, S. 1-12 hr. PR: Biomechanics 316 and Orthodontic Technique 317. Clinical treatment of selected patients.
- 497. **Research.** I, II, S. 1-15 hr.

## DIVISION OF MEDICAL TECHNOLOGY

A master of science degree is offered by the Division of Medical Technology of the School of Medicine with the cooperation of the Division of Education, College of Human Resources and Education. Individuals entering this program should be mature, experienced medical technologists who desire to strengthen their skills in teaching, administration, and supervision, and to broaden their knowledge in the specialties of medical technology. The program is designed to permit as much freedom in the choice of course work as possible and to provide an opportunity for recognition and development of the student's abilities.

The admission procedure is the same as for other programs in the Graduate School. Applicants must have a bachelor's degree from an accredited institution. The desired area of concentration in medical technology is considered in the evaluation of the undergraduate record. Applicants are selected for admission on the basis of scholastic standing, recommendations, and interest in the field of health and medical technology education. The number of applicants accepted is limited by the available facilities.

The course of study is tailored to the needs of the student. It is expected that students who enter the program have a goal in mind and a special field of interest in medical technology. A minimum of 36 semester hours of credit, including a research problem or thesis, is required. These credits are distributed among courses in: (1) an area of concentration in medical technology selected by the student, (2) research and statistics, and (3) health education.

The student has ample opportunity to satisfy individual goals through elective courses and research. Elective courses are not specified and will vary from student to student.

The program can be divided into three areas, as follows:

*Area of Concentration:* Graduate courses in hematology, microbiology, chemistry, cytology, and histopathology are available. Special work in the clinical phases of medical technology is obtained through registration in Med. Tech. 397 (1-15 hr.). This course gives the student an opportunity to work in special areas such as administration, education, hematology, blood banking, clinical chemistry, and microbiology under the guidance of a member of the graduate faculty.

### Required Courses in Research and Statistics

Ed. Psych. 330. **Advanced Educational Measurement.** I, II. 3 hr. Background for educational measurement, the nature of evaluation, measuring and predicting pupil progress. Basic statistics including measures of central tendency, percentiles, variability, and simple correlation.



- Ed. Psych. 320. **Introduction to Research.** I, II, S. 3 hr. PR: Ed. Psych. 211. **Introduction to methods and techniques of research in education.** Major emphasis in design, analysis, interpretations, and reporting of research.
- Med. Tech. 497. **Research.** 1-15 hr.

In order that the graduate student will be aware of other fields in the health sciences the following 3-hr. courses are required:

- Health Ed. 301—Advanced School Health
- Health Ed. 305—Philosophy of Health Education
- Health Ed. 306—Community Health
- Safety Ed. 300—Philosophical Concepts in Safety
- Health Ed. 376—Evaluation of Health Information

#### **Requirements for Degree**

All requirements for the degree of master of science, as outlined in Part II of this bulletin, must be met. These requirements can be fulfilled in three semesters by full-time students. If necessary, additional time may be permitted.

Degree candidates must have a 3.0 grade-point average for graduation and must successfully pass comprehensive examinations.

Examinations include:

A. A preliminary comprehensive examination in Health Education after completion of twelve semester hours of work in residence. (It is the student's responsibility to make arrangements for this examination.)

B. A written final comprehensive examination given one month prior to the granting of the degree. This examination covers the field of:

1. Medical technology with emphasis on the area of concentration.
2. Research and statistics.
3. Health Education.

C. An oral final comprehensive examination on the student's problem given after the problem is completed.

### **SCHOOL OF PHARMACY**

The School of Pharmacy offers programs of graduate study leading to the degree of Master of Science in the Pharmaceutical Sciences. Students may specialize in pharmaceutics, pharmacy administration, pharmacognosy, pharmaceutical chemistry (organic-medicinal or pharmaceutical analytical), or pharmacy.

#### **Admission**

Applicants for admission to the program must satisfy the general requirements for admission to the Graduate School of West Virginia University. Beyond this, the applicant should possess a B.S. degree with a minimum overall average of 2.75. In exceptional cases, a student with course deficiencies or with a grade-point average below 2.75 may be admitted as a special graduate student. The record of the student will be reviewed at the end of 12 hours, and he may be allowed to pursue a degree program upon removal of any deficiencies and/or demonstration of ability to perform satisfactorily in the graduate program.

## Academic Standards

No credits are acceptable toward a graduate degree which are reported with a grade lower than a "C".

The graduate student must have a cumulative grade-point average of at least 3.0 in all graduate courses to qualify for the degree.

## Requirements for Completion of Degree

Upon acceptance to the program, the student will select his major adviser who will also serve as chairman of his advisory committee and of his examination committee, and as his thesis supervisor. The advisory committee will approve a plan of study and a research project for the thesis requirement.

To be eligible for the degree, the student must complete a minimum of 30 hours of graduate credit, of which no more than 6 hours may be for research and thesis.

Upon completion of the course work and research requirements, and after submission of the thesis, an oral examination will be administered by the appointed examination committee.

Further information may be obtained by writing to the Dean, School of Pharmacy, West Virginia University, Morgantown, W. Va. 26506.

## Pharmaceutics

300. **Industrial Pharmaceutics.** 4 hr. An introduction to the manufacture of dosage forms and their quality control. The structure of the industry and governmental influences are included. Special attention is given to new drug evaluation with regard to safety and efficacy. 2 hr. lect., 2 hr. lab.
301. **Advanced Pharmaceutics.** 3 hr. An advanced study of the physicochemical and biopharmaceutical principles involved in homogeneous systems (solutions) which function as dosage forms. Included are considerations of kinetic processes of solution, stability, complexation, solubility, the pharmacokinetics within the body, adjuncts of palatability, etc. 3 hr. lect.
302. **Advanced Pharmaceutics.** 3 hr. An advanced study of the physicochemical and biopharmaceutical principles involved in disperse systems (liquid, semi-solid and solid) which function as dosage forms. Included are considerations of the properties of solid dispersions, micromeritics, diffusion of liquid dispersions, interfacial phenomena, emulsification, suspensions, prolonged action medication, etc. 3 hr. lect.

## Pharmacy Administration

320. **Drug Regulation and Control.** 3 hr. A detailed study of legislation affecting the development, introduction, control, and utilization of drugs in the American economy. 3 hr. lect.
321. **Drug Distribution Systems.** 3 hr. A detailed study and analysis of drug distribution in institutional environments. 3 hr. lect.
323. **Economics of the Pharmaceutical Industry.** 3 hr. The history, background, and formation of major drug industries. Topics include oligopolistic practices, mergers, combines, costs of research, and production. 3 hr. lect.

## Pharmacognosy

240. **Pharmacognosy. II.** 6 hr. PR: Consent. A study of drugs of biological origin, both plant and animal; their specific origins, methods of preparation, active

constituents, and medicinal and pharmaceutical uses. Example of the methods used in the isolation and study of such products are presented in the laboratory. 5 hr. lect., 1 hr. lab.

- 340. **Organic Plant Constituents.** 3 hr. A survey of the occurrence, properties, biogenesis, etc. of a number of classes of organic compounds derived from plants. Emphasis will be placed on those classes of secondary metabolites which contain products of pharmaceutical or medicinal interest. 3 hr. lect.
- 341. **Isolation of Plant Constituents.** 3-5 hr. A course designed to acquaint the student with techniques used in the extraction, separation, and isolation of plant constituents. 1 hr. lect., 2-4 hr. lab.

#### Pharmaceutical Chemistry

- 272. **Organic Pharmaceutical Chemistry. I.** 3 hr. PR: Consent. A study of synthetic drugs and certain natural drug products, with regard to nomenclature, synthesis and therapeutic, physical and chemical properties. 3 hr. lect.
- 273. **Organic Medicinal Chemistry. II.** 3 hr. PR: Consent. A continuation of Ph.Ch. 272 with special attention given to structure-activity relationship. 3 hr. lect.
- 274. **Pharmaceutical Analysis. I.** 4 hr. PR: Consent. Application of basic scientific principles to the quality control of drugs and dosage forms, with particular attention to newer analytical techniques. 2 hr. lect., 2 hr. lab.
- 370. **The Synthesis of Drugs.** 4-5 hr. A course embodying the design of drug molecules on the basis of structure-activity relationships and approaches to the synthesis of such compounds. Laboratory to accompany in which representative types of biologically active compounds are prepared. 3 hr. lect., 1-2 hr. lab.
- 375. **Advanced Pharmaceutical Analysis.** 3 hr. An overview of methods of spectroscopic methods of analysis with emphasis on their applications in pharmaceutical problems and in the biological sciences. 2 hr. lect., 1 hr. lab.
- 376. **Advanced Pharmaceutical Analysis.** 3 hr. A continuation of Ph.Ch. 375, with emphasis on electro analytical methods and the preparation of samples from pharmaceutical dosage forms and from biological materials. 2 hr. lect., 1 hr. lab.
- 377. **Advanced Pharmaceutical Analysis.** 3 hr. A study of the physical-chemical principles involved in methods development. A special problem is assigned as an integral part of the course. 1 hr. lect., 2 hr. lab.

#### Pharmacy

- 390. **Special Problems in Pharmaceutical Sciences.** 1-3 hr. Where special interest is shown by the student in an area other than that of his thesis research, a faculty member will supervise individual study and research. 1-3 hr. lab.
- 391. **Seminar in Pharmaceutical Sciences.** 1 hr. Presentation and discussion of special topics and research in the pharmaceutical sciences.
- 497. **Research.** 1-15 hr.



# School of Physical Education

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## Admission

Students who wish to enter the Graduate School file application for admission with the Director of Admissions of the University. The applicant must request that the registrar of the college or university previously attended send an official transcript directly to the Director of Admissions at least one month in advance of the registration period. Application forms may be obtained from the Director of Admissions of the University.

Admission to Graduate School does not constitute admission to candidacy for the Master of Science degree. The Chairman of Graduate Studies in the School of Physical Education will advise the student concerning departmental prerequisites and advanced degree requirements.

## The Degree of Master of Science in Physical Education

The School of Physical Education offers courses leading to the Master of Science degree, with an emphasis in School Physical Education or Sport Studies.

Students are admitted for graduate work leading to the M.S. Degree in the School of Physical Education, provided they hold a baccalaureate degree from an approved college; have a 2.5 undergraduate grade-point average (based on a 4.0-point system); and satisfy prerequisites in the courses for which they register.

Students who do not meet the 2.5 grade-point average requirement may be admitted on probation and will be required to earn a 3.0 average in the first 12 semester hours of residence work in order to continue.

Students are accepted as advanced degree candidates on the basis of a preliminary qualifying examination following one semester, or two summer terms, (12 semester hours)\* of graduate residence work, provided they:

A. Are certified to teach physical education; or have at least 24 semester hours, or its equivalent\*\* which is an undergraduate minor in physical education. The equivalent is determined by the Committee on Graduate Courses.

B. Demonstrate to the satisfaction of the Committee on Graduate Study by a Preliminary Comprehensive Examination, taken after completing 12 hours in residence, a grasp of the important phases and problems in the major interest area.

Thirty-six semester hours are required for the Master of Science degree, distributed as follows:

- I. Satisfactory completion of the disciplinary core courses for the Master of Science Degree. These courses are: P.E. 320, P.E. 340, P.E. 360, and P.E. 380.

\*Courses taken in University Extension are accepted for degree purposes provided the student has had prior approval from his adviser.

\*\*Experience in teaching Physical Education and Safety Education and coaching experience may be evaluated by special examination to adjust some of the undergraduate requirements.

II. In addition to the basic disciplinary core the student may elect to pursue either the curriculum devoted to School Physical Education or Sport Studies.

**a. School Physical Education**

1. 12 semester hours of basic Physical Education core.
2. 9 semester hours of professional physical education courses including P.E. 305, P.E. 445, and P.E. 446.
3. 6 semester hours of required courses in professional education including Ed. 330 and Ed. 320.
4. 9 semester hours elected in approved professional education courses.

**b. Sport Studies**

1. 12 semester hours of basic Physical Education core.
2. 6 semester hours in social research and statistics.
3. 3 semester hours in P.E. 345.
4. 9 semester hours elected from approved courses in psychology or sociology.
5. 6 semester hours of thesis.

## **The Degree of Master of Science in Safety**

The School of Physical Education offers courses leading to the Master of Science Degree, with emphasis in Safety.

### **Degree Requirements**

Students may be admitted for graduate work leading to the M.S. Degree in Safety provided that a baccalaureate degree from an approved college has been completed in areas such as: Business Management, Engineering, Industrial Arts, Physical Education, Physical Science, Psychology-Sociology, or Safety. A 2.5 undergraduate grade-point average (based on a 4.0-point system) is expected. Otherwise, admission must be of probationary status which requires the student to earn a 3.0 average on the first 12 semester hours of residence work in order to continue. Additionally, students will be expected to have completed the Aptitude Test of the Graduate Record Examination and departmental Preliminary Qualifying Examination by the end of the semester or summer term in which they register for their twelfth semester hour of residence work.

A student is accepted as an advanced candidate for his degree providing course work and results of examinations previously mentioned are of a satisfactory nature as judged by the graduate committee of the department.

A candidate must complete a minimum of 36 credit hours including an approved research problem in safety to qualify as a degree recipient. A grade-point average of 3.0 will be required for graduation.

The general regulations of the Graduate School in regard to transfer and extension credit plus time limitations will be followed.

During the final term or semester of study, each student will be required to pass successfully an examination dealing with the core subject matter and specialization emphasis.

Courses in the required departmental "core" include: 300, 310, 311, 418, 472, and 497. Additional course work must be planned in consultation with the adviser. Electives are designed to enable fulfillment of interests and needs of both safety education and safety management professionals. Six semester hours

of course work may be devoted to directed electives from one of the student's undergraduate major or minor fields or from a field allied to Safety. Approval by the adviser must be obtained prior to enrollment in such electives by students.

## **Certificate of Advanced Study Program**

The program, in cooperation with the College of Human Resources and Education, is designed to prepare school and related personnel who wish professional education beyond the Master's degree. Candidates for this Certificate may choose from among the following areas of study for their specialization: Physical Education or Safety.

### **Prerequisites for Admission to the Program**

1. General requirements for admission to the Graduate School of West Virginia University.
2. A Master's degree with a grade-point average of 3.0 or higher.
3. A minimum of three years of teaching or closely related educational experience.

### **Requirements for Admission to Candidacy**

1. Evidence through examination, personal letter, and personal interview of general proficiency, acceptable standards or oral and written communication, and good health.
2. Satisfactory completion *in residence* at West Virginia University of at least 6 semester hours of approved course work beyond the conferring of the Master's degree.

### **Requirements for Completion**

*The Program:* An approved program consisting of a minimum of 30 semester hours earned above the Master's degree of which 24 semester hours will be course work in Professional Education and Physical Education or Safety with a minimum of 6 hours of research.

At least 24 semester hours of the work credited for this Certificate must be done in residence at West Virginia University. This requirement includes the 6 hours of research which may be conducted apart from the physical limits of the University but must be done under the direction and supervision of the chairman of the student's graduate committee. A maximum of 6 semester hours earned in residence at another approved graduate institution or in West Virginia University Extension may, if approved by the student's adviser, be allowed toward credit for the Certificate.

*Final Examination:* Upon completion of all requirements including the research report, the candidate will be admitted to a final oral examination by his graduate committee.

*Time Limitation:* All requirements must be completed within seven calendar years immediately preceding the awarding of the Certificate.



## **The Degree of Doctor of Education in Physical Education or Safety Education**

The degree of Doctor of Education is offered in cooperation with the College of Human Resources and Education. Admission to the Graduate School and enrollment in graduate courses do not imply acceptance of the applicant for a Doctor of Education degree.

*Admission.* Individuals who wish to pursue a program leading to the Doctor of Education degree must be admitted to the Graduate School of West Virginia University. All applicants for admission to the doctoral program must submit scores on the Aptitude Test of the Graduate Record Examination and otherwise comply with each of the general regulations of the Graduate School outlined in Part I and Part II of this Catalog. Acceptance for study toward the doctoral degree in a specific area of concentration will be based on prior academic achievement including a cumulative grade-point average of 3.0 or above and a satisfactory score on the general aptitude test of the Graduate Record Examination or other appropriate measure of academic aptitude, and an interview by the Doctoral Admissions Committee during the Preliminary Examination. Students having a cumulative grade-point average of less than 3.0 but having a satisfactory score on the Graduate Record Examination or other appropriate measure of academic aptitude may be admitted provisionally; final acceptance will be contingent upon the results of the Preliminary Examination. Students who meet the standards for admission set forth by the various programs will be assigned a temporary adviser.

*Preliminary Examination.* The student must make application through his temporary adviser to the Chairman of Graduate Studies to take the Preliminary Examination. Usually, the examination is taken after tentative admission to the program and completion of six to twelve hours of doctoral work at West Virginia University. A maximum of eighteen (18) hours credit of doctoral work completed at West Virginia University prior to the preliminary examination may be counted.

The purposes of the preliminary examination are to discuss with the student his proposed area of doctoral study, and to make appropriate recommendations concerning his acceptance into an area of concentration and acceptability of prior work to meet program requirements.

The composition of the preliminary examining committee shall include, at least, the Chairman of Graduate Studies, the coordinator of the major program, the coordinator(s) of minor program(s), and the student's temporary adviser. Prior academic achievement, professional experiences, test results, and other evidences of competence in areas essential for successful completion of the Doctor of Education Degree will be taken into consideration.

*Doctoral Committee.* Having received an affirmative recommendation from the preliminary examination committee to continue doctoral work, a permanent adviser to serve as the chairman of the student's doctoral committee will be selected by the Dean, the Director of the Division, and the Coordinator of the Major Program. At least four additional committee members will be selected by the permanent adviser and the student.

*Curriculum.* The final determination of the program of course work and research is the responsibility of the student's doctoral committee. The Doctor of

Education degree is not awarded on the basis of the completion of any set number of credits but is awarded on the basis of demonstrated academic achievement and scholarly competence. The minimum course work shall be 70 semester hours of graduate work, excluding dissertation credit but including credits of relevant graduate work completed at the master's degree level. A minimum of 24 of the 70 semester hours shall be in the area of major concentration and a minimum of 24 of the 70 semester hours from a minor area of concentration in a supporting or related discipline.

Candidates having previously earned a graduate degree from West Virginia University will be required to earn credit in residence at another graduate institution offering the doctorate in the student's major field. The student's doctoral committee shall approve the institution and the course work. In every case, a minimum of two semesters in residence at West Virginia University as a full-time doctoral student will be required. Requirements for the Doctor of Education degree must be completed within seven years after successful completion of the preliminary examination.

Courses which may be counted toward the major area of the degree program in Safety include pertinent courses not previously taken at the Master's degree level plus the following: Safety 410, 452, 454, 457, 458, 459, and 497.

Suggested courses beyond the Master's degree in the area of physical education which may be applied to the doctoral degree are: P.E. 306, 365, 367, 425, 460, 465, and 480.

*Admission to Candidacy Examination.* The purposes of the admission to candidacy examination are to assess the quality of the student's academic achievement, to review the student's program of course work, to approve a proposed outline of dissertation research, and to admit the student to formal candidacy for the degree.

The examination may be taken after at least two-thirds of the student's program of course work has been completed but prior to the dissertation phase of the program. The admission to candidacy examination consists of two parts: (a) a written examination, and (b) an oral examination. The candidate must pass the written examination prior to taking the oral portion. The written examination will include a common "foundations" section (history and philosophy of education, research design and statistics, social and psychological foundations) and specifically prepared written examinations in the areas of Physical Education and Curriculum and Instruction. The written examination may be repeated one time and, upon consent of the Dean, Director of Division, and Coordinator of Major Program, may be repeated a second and third time. At least six months must elapse between repeated examinations.

The oral portion of the admission to candidacy examination will be administered by the student's doctoral committee at the call of and under the direction of the committee chairman after successful completion of the written portion of the examination. The oral portion of the examination may be repeated one time, and, on recommendation of the doctoral committee, may be repeated a second time. At least six months must elapse between repeated examinations. On successful completion of the admission to candidacy examination, the student will be admitted to formal candidacy for the doctoral degree.

*Dissertation.* The candidate must submit and justify an outline or a prospectus for his doctoral dissertation at the oral portion of the admission to candidacy examination. The doctoral committee must review and *approve, approve with change, or reject* this outline or prospectus. The student shall systematically consult with members of the doctoral committee and with other appropriate members of the University faculty during the dissertation phases of his program.

*Final Oral Examination.* The student will be admitted to a final oral examination upon completion of his dissertation and after he has fulfilled all other requirements set by his committee. This examination will be conducted by his doctoral committee and will be open to all members of the University faculty. The candidate will not be recommended for the doctoral degree if he receives more than one unfavorable vote from his doctoral committee.

## Physical Education

### P.E.

278. **Administration of Physical Education.** I, II, S. 3 hr. PR: P.E. 71, 177. Modern theories in physical education and guiding principles in organization and administration of the program.
300. **Workshop in Physical Education.** I, II, S. 1-15 hr.
305. **Philosophical Concepts in Physical Education.** I, S. 3 hr. PR: Graduate standing or consent. Study of educational philosophies and application of these philosophies to physical education; study of the place of physical education in education and modern living.
306. **Scientific Interpretations of Physical Education.** I. 3 hr. PR: Graduate standing. A synthesis of the behavioral and biological sciences as a foundation for advanced study in the disciplinary content of sport science and physical education.
320. **Individual Interaction in Sport and Physical Activity.** I, S. 3 hr. PR: Graduate standing or consent. Designed to acquaint the student with the reciprocal relationships between sport and physical activity and the societies and cultures out of which sport emerges. It is an in-depth analysis of the study of sport utilizing sociological investigatory methods as frames of reference.
340. **Psychology of Sport and Physical Activity.** I, S. 3 hr. PR: Graduate standing or consent. Study of the psychological effects and implications of man's participation in sport and physical activity. Emphasis on psychological and learning theory, personality, and performance in physical activity.
345. **Group Influences in Sports.** I. 3 hr. PR: Research, Statistics, P.E. 320, P.E. 340. The content of this course is concentrated upon the manner and degree to which selected psychological processes of individuals are affected by involvement in sports.
360. **Bio-Mechanical Analysis of Sport and Physical Activity.** II, S. 3 hr. PR: Human Anatomy and Physiology, Physics, and Kinesiology. Advanced principles of body mechanics and analysis of muscle and joint actions in coordinated movement and neuromuscular physiology.
365. **Psychomotor Behavior Analysis.** II, S. 3 hr. PR: Doctoral standing. An in-depth study of psychomotor learning with emphasis on behavioral change in physical activity. Review of research and psychological thought pertinent to motor learning, personality, performance, and physical activity.
367. **Theories of Sport Physiology.** I, S. 3 hr. PR: Graduate standing. A thorough and workable knowledge of principles involved in the interactions of muscles



and nerves, reflexes, metabolism, cardiopulmonary function, environmental physiology and the practical application of work physiology.

380. **History of Sport and Physical Activity. II.** S. 3 hr. PR: Graduate standing or consent. An anthropological and historical approach toward the influence of events, political and social climates, and personalities upon the sport cultures from early civilizations to the present.
425. **Educational Sport. II.** 3 hr. PR: Ed. 399, Stat. 211, P.E. 306, P.E. 465. This course treats the group dynamics of the sport situation for purposes of gaining insight into the techniques and methods of modifying social behavior through physical education sport activities.
445. **Program Planning I. II.** S. 3 hr. PR: Graduate standing or consent. An in-depth study of the manner in which the physical education environment is structured to elicit cognitive and psychomotor learnings, with an emphasis on program design, behavior modification, and evaluation processes.
446. **Programming Planning II. I.** S. 3 hr. PR: Graduate standing or consent. An in-depth study of the manner in which the physical education environment is structured to elicit affective learnings. Emphasis on program design, social learnings, behavior modification, and evaluation procedures.
460. **Management Processes in Physical Education. II.** 3 hr. PR: Doctoral standing or consent. An analytical exploration of the situational, relational processes between the administrator of physical education school programs and the teacher of physical education, the physical education facility, and the physical education planned learning environment.
465. **Professional Physical Education Resource Seminar. S.** 3 hr. PR: Doctoral standing. This course is an introductory seminar for Doctoral professional physical educators. Discussions and readings will center around current thought about physical education in its historical perspective.
480. **Dissertation Seminar. I, II.** S. 3 hr. PR: Advanced doctoral standing. This seminar is devoted to a critical analysis of the doctoral candidate's research proposal. Concentration will be on the statement of the problem, definitions of terms, research design, and methods of analyzing the data intended to be used in the candidate's research study.
497. **Research. I, II.** S. 1-15 hr.

## Dance

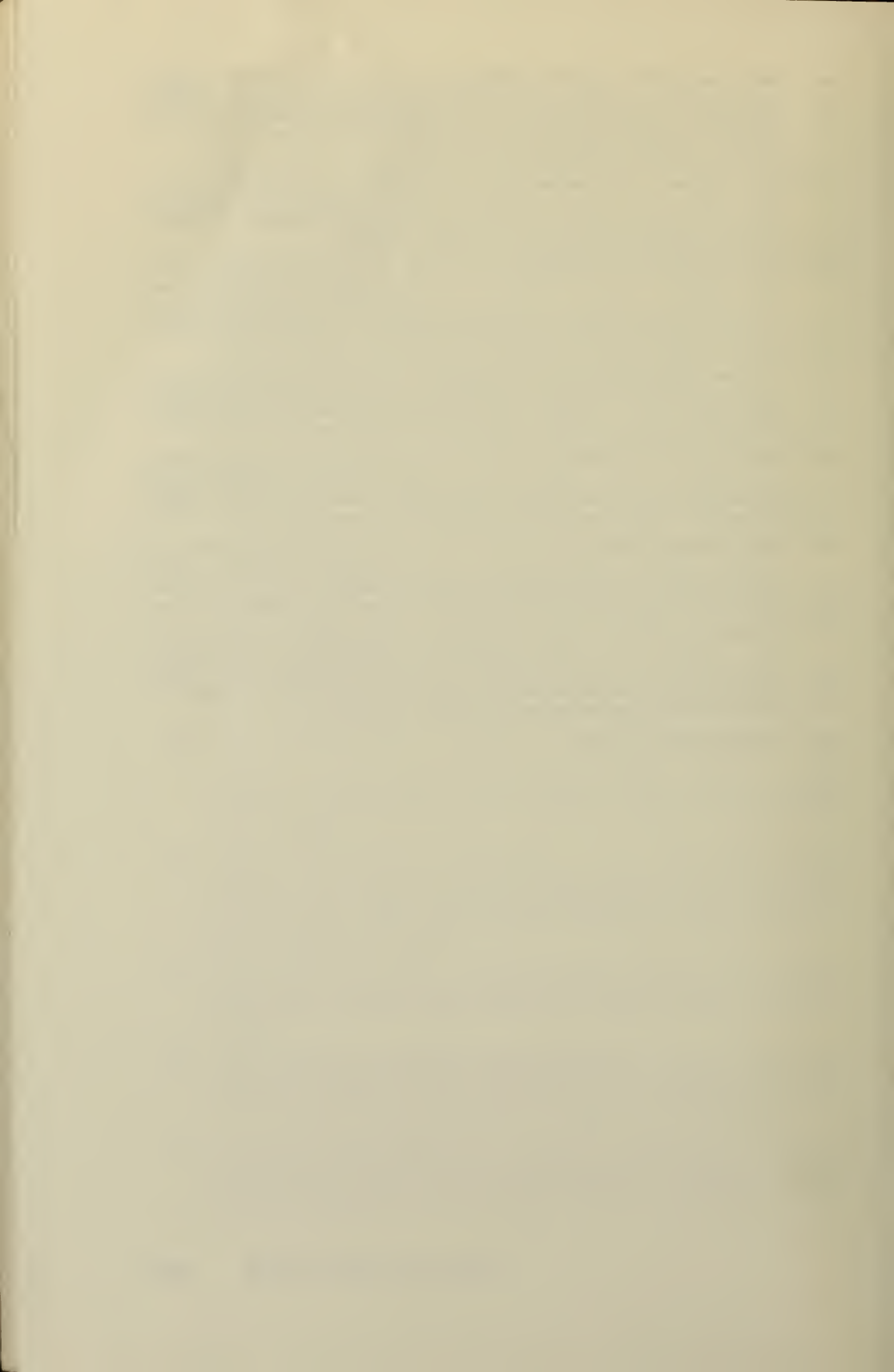
400. **History and Philosophy of the Dance.** 3 hr. PR: P.E. 402 or equiv. A cultural survey of the dance as an expression of the society it represents; philosophy of the dance; the relation of the dance to other art forms; dance as an educational experience and the study of the works of the outstanding artists of today.
401. **Rhythms and Dance.** 3 hr. PR: Graduate standing and consent. Principles of movement, materials, and practicum in dance.
402. **Modern Dance Techniques and Composition.** 3 hr. PR: P.E. 35 and 36, graduate standing and consent. Application of scientific principles of movement; basic principles of music as related to dance movement; choregraphic principles; practicum in dance movement. Principles for teaching the dance and problems involved in planning programs.
403. **American Folk Dance.** 3 hr. PR: P.E. 132 or equiv. Study of American square, contra, circle, and round dances and play party games and their place in community and school recreation programs. Their relationships to the arts and other aspects of American culture. Analysis of techniques in leading and calling.

## Safety

300. **Philosophical Concepts in Safety.** I, S. 3 hr. Philosophies of the safety movement as expressed by leaders in the field are related to accident causation, accident prevention, and research implications. Emphasis is placed upon the relationships of environmental safety, safety services, and safety instruction to the major safety problems of modern living.
310. **Environmental Aspects of Hazard Control.** I, S. 3 hr. PR: Safety 300 or consent. An investigation of hazard control principles relating to environmental objects, facilities, and equipment and control procedures recommended by authorities from the fields of engineering, medicine, and public health as well as from the field of safety.
311. **Human Factors in Accident Prevention.** II, S. 3 hr. PR: Safety 300 or consent. Investigation of concepts dealing with human behavior as related to accident experience in major reporting categories with consideration of psychological and sociological implications as well as motivational problems.
333. **Disaster Preparedness and Emergency Systems.** I, S. 3 hr. PR: Consent. Study of major elements involved in disasters and emergencies, preparedness planning, systems utilization, and attention to essential human services, with emphasis on community action.
336. **Occupational Safety Program Management.** II, S. 3 hr. PR: Safety 300, or consent. Management guidelines, personnel techniques, and operational features applicable to safety programs designed for business, government, and industrial organizations.
337. **Personal and Environmental Safety Supervision.** II, S. 3 hr. PR: Safety 300, or consent. Supervisory methods, tools, and techniques designed to develop safety leadership qualities, to promote human relations, and to motivate employee responsibility for safe living practices.
351. **Safety and Traffic Education Content Areas.** II, S. 3 hr. PR: Consent. Study and analysis of content areas usually recommended for instructional programs within the field of safety, with emphasis on promotion of safe living practices.
354. **Driver and Traffic Safety Education.** I, S. 3 hr. PR: Safety 151 or 300 or equiv. and valid driver's license. Intended for graduate students who desire preparation in driver education, the course includes objectives, content, methods, and advanced instructional techniques for both school and adult programs. Arranged laboratory provides experience in supervision of practice driving for beginners.
356. **School and College Safety Administration.** II, S. 3 hr. PR: Graduate major in Safety, or consent. Current emphasis in administering and supervising safety education, safety services, and environmental safety at various program levels from elementary school through college. Relationships between elements of various programs are stressed.
410. **Resource Seminar in Safety.** I. 3 hr. PR: Safety 300 and consent. Investigations, analyses, and discussions dealing with the varied sources of publications, material aids, consultant services, and other assistance available to safety professionals.
418. **Safety Measurement, Evaluation, and Research.** II, S. 3 hr. PR: Safety 300. Analysis of evaluative data and statistical procedures applicable to the safety field plus investigation of nature and purposes of research dealing with safety and accident prevention with emphasis on human and environmental factors.
431. **Automotive Transportation Safety.** I, S. 3 hr. PR: Safety 300 and 310, or consent. Considers safety elements of automotive and other forms of transportation equipment, design, and control plus legislation and planning at federal, state, and local levels for improved safety features of transportation systems.

451. **Safety and Traffic Education Problems. I.** S. 3 hr. PR: Advanced graduate major in Safety or consent. Consideration of current and persistent problems in the field of safety in general and the component area of safety and traffic education. Seminar emphasis also extends attention to safety problems and issues of concern to participating class members.
452. **Safety Manpower Development. II.** 3 hr. PR: Consent. Safety manpower positions, needs, and problems in relation to efforts of business, government, industry, and educational agencies to provide sufficiently effective professional and sub-professional preparation of safety practitioners.
454. **Safety Simulation and Innovations. S.** 3 hr. PR: Safety 254 and 354 and teaching experience in driver education or consent. Advanced Course which considers individual problems and emphasizes newer media plus unique adaptations as revealed by research and current literature in the field. Latest publications dealing with curriculum and supervision are examined.
457. **Planning and Coordinating Safety Programs. I.** 3 hr. PR: Advanced graduate standing in Safety or consent. Investigation of organizational structure, planning resources and techniques, and coordination functions involving safety programs in business, industry, government, and education.
458. **Safety Program Operational Research. II.** 3 hr. PR: Advanced graduate standing in Safety or consent. Study and application of program evaluation concepts and techniques plus consideration of operational research procedures applicable to safety education, safety services, and environmental safety.
459. **Safety Research Seminar. II.** 3 hr. PR: Advanced doctoral major in Safety and consent. Analysis of research designs and procedures for compilation, organization, treatment, and interpretation of data for safety research projects. (Required of all candidates for doctoral degrees in safety and traffic education.)
472. **Practicum in Safety. I.** 3 hr. PR: Advanced doctoral major in Safety and consent. Individual and/or group experiences in development, implementation, and participation in special projects involving safety education, safety services, and environmental safety in schools, colleges, or communities. A minimum of 100 clock hours must be devoted to applied experiences.
497. **Research. I, II, S.** 1-15 hr.





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